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ABSTRACT

This thesis presents a comparative analysis of the National Labor Relations Board (NLRB) and the Impartial Jurisdictional Disputes Board (IJDB) when resolving jurisdictional dispute cases. The former system is a statutory procedure legislated by Congress. The later procedure is a voluntary system established by management (contractors) and labor, which has come under fire lately. The primary objective of this study is to determine if management and organized labor prefer a voluntary system or the NLRB for resolving jurisdictional disputes, (2) determine if there is a basis of understanding between management and labor upon which a practicable voluntary alternative system can be established and (3) characterize the features that are prerequisites to the acceptance of a voluntary alternative to the NLRB. Another objective is to prepare a comparative analysis of the IJDB and NLRB by showing the advantages and disadvantages of the two systems. Both union and management agree on the need for a voluntary resolution procedure. The issues supporting, as well as hindering this objective are synthesized in this thesis.



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The Pennsylvania State University

The Graduate School

Department of Civil Engineering

An Evaluation of Alternative Resolution Procedures  
for Jurisdictional Disputes in the  
Construction Industry

A Thesis in

Civil Engineering

by

Dennis William Heuer

Submitted in Partial Fulfillment  
of the Requirements  
for the Degree of

Master of Science

March 1983

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A thesis submitted to the Pennsylvania State University,  
University Park, PA in partial fulfillment of the  
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## ABSTRACT

This thesis presents a comparative analysis of the National Labor Relations Board (NLRB) and the Impartial Jurisdictional Disputes Board (IJDB) when resolving jurisdictional dispute cases. The former system is a statutory procedure legislated by Congress. The later procedure is a voluntary system established by management (contractors) and labor, which has come under fire lately. The primary objective of this study is to determine if management and organized labor prefer a voluntary system or the NLRB for resolving jurisdictional disputes, (2) determine if there is a basis of understanding between management and labor upon which a practicable voluntary alternative system can be established and (3) characterize the features that are prerequisites to the acceptance of a voluntary alternative to the NLRB. Another objective is to prepare a comparative analysis of the IJDB and NLRB by showing the advantages and disadvantages of the two systems. Both union and management agree on the need for a voluntary resolution procedure. The issues supporting, as well as hindering, this objective are synthesized in the thesis.

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## CHAPTER ONE

### INTRODUCTION

In the study of the construction industry a perceptive observation has been made by Justin Sweet, Professor of Law, University of California (Berkeley), in describing its instability. He states, "construction is a complex undertaking and a dispute-prone activity. The volatility of the construction industry adds to the high probability of construction project disputes. Guidelines are needed to spell out clearly and completely the rights and duties of the parties." (49:236,316).

One of the specific disputes encountered in the construction industry is that of work slowdowns or stoppages due to craft union conflicts over the right to perform certain work tasks. This type of dispute is called a jurisdictional dispute. A conflict arising between the carpenters and sheet metal workers over who has the right to erect and install interior metal trim, such as door jambs, doors, and chair rails is an example of a jurisdictional dispute.

During the last fifty years, the construction industry has undergone tremendous changes. Construction methods and

materials change and improve over time. The use of power trowels for cement finishing, prehung doors and windows and frames being manufactured as a single unit are examples of these changes. More efficient operations require less craftsmen per job, as well as new and better equipment. As changes surfaced, the instinct of each union was to preserve and protect the work rights of its members. For example, when lumber was the primary material for doors, door jambs and trim, there was no question that the work belonged to the carpenters. However, as metal trim became a more desirable and cost effective material the carpenters were faced with losing previously exclusive work to another trade union, namely, the sheet metal workers.

When two parties maintain a claim to the same work and refuse to compromise, the threat of work delays, shutdowns and slowdowns is significant. Jurisdictional disputes can create considerable hardships for the contractor who employs the unions craftsman. His objectives are to construct the project within time and budget and to the degree of quality established in the contract documents. Accordingly, the contractor is not always supportive of the union objectives. A timely, efficient and fair procedure is needed for resolving jurisdictional disputes. Such a procedure is in the best interest of owners, contractors, and union tradesmen alike.

### Background

In 1947, Congress passed the Labor Management Relations Act, also known as the Taft-Hartley Act. One of the significant aspects of this Act was that it defined unfair labor practices on the part of labor. Jurisdictional disputes were discussed in Section 8(b)(4)(D) of Taft-Hartley. The mere claim by two unions to the right to perform certain work is not illegal, however it is considered illegal if the dispute adversely affects the employer (in construction, the employer is generally a contractor).

The authors of the Taft-Hartley Act recognized that legislation would not eliminate conflicts. Instead, they sought to institutionalize them. The primary method of accomplishing that was to grant the National Labor Relations Board (NLRB) the primary function of adjudication of unfair labor practices. It was also recognized that the NLRB was not the ultimate solution. In section 10(k), the Act encouraged parties involved in a dispute to agree "upon methods for the voluntary adjustment of the dispute." Therefore, two avenues of dispute resolution emerged: (1) the statutory procedure utilizing the NLRB and (2) voluntarily alternative procedures, which preclude NLRB intervention.

The AFL-CIO Building Trades Department and union

contractor employer associations have endeavored to devise such a voluntary alternative settlement procedure to handle jurisdictional disputes. The belief that parties to a jurisdictional dispute would be more receptive to a settlement developed through a mechanism that all parties had voluntarily agreed upon, formed the basis for establishing the National Joint Board for the Settlement of Jurisdictional Disputes (NJB). This procedure was accepted in 1948. From the union viewpoint, the alternative approach was much more acceptable than the NLRB alternative. The unions feared that the NLRB would grant the contractor total freedom to make work assignments because the NLRB attached minimal importance to past practices.

The National Joint Board (NJB) remained unchanged until 1965. At that time, changes were made to the NJB procedures used to render work assignment decisions. Adoption of some NLRB practices used in reaching decisions was agreed upon. The purpose was to reduce the attractiveness of the NLRB to members of the construction industry.

Both unions and contractors were dissatisfied with the changes made to the NJB and in 1969, the NJB collapsed. Subsequent negotiations led to the creation, in 1970, of a new voluntary alternative procedure. Many of the features of the new procedure were similar to the NJB. However, one major difference was the selection of an impartial chairman.

Another significant change allowed a contractor who was a victim of a jurisdictional strike that exceeded forty-eight hours to seek a court or NLRB injunction to order union craftsmen back to work. This escape clause was designed to force the international unions to either settle the jurisdictional matters or permit the contractor to pursue another means (10:9). Additional changes were made in 1973 at which time the plan was renamed the Impartial Jurisdictional Disputes Board (IJDB).

In 1981, general dissatisfaction of both parties resulted in the suspension of the IJDB. The issues involved center on the fundamental criteria considered in resolving disputes and the degree to which the judicial system should be involved.

### Objective

The primary objective of this study is to determine if management (contractors) and organized labor prefer a voluntary system or the NLRB for resolving jurisdictional disputes, (2) determine if there is a basis of understanding between management and labor upon which a practicable voluntary alternative system can be established and (3) characterize the features that are prerequisites to the acceptance of a voluntary alternative to the NLRB. Another objective is to prepare a comparative analysis of the IJDB

and NLRB by showing the advantages and disadvantages of the two systems.

### Research Methodology

This study uses the methodology of evaluation research for examining the recently suspended IJDB. The evaluation research focuses on the positive and negative attributes, as viewed by contractors (management) and organized labor. The effectiveness of the IJDB is compared to the NLRB alternative to determine if a voluntary settlement procedure is desirable.

To accomplish the study objectives, a three-phased approach was followed. These phases are described below. Phase I involved a literature review of available documents from the Pattee Library, The Pennsylvania State University and other sources. The purpose of this phase was to achieve an understanding of the procedures, practices and legal authority of the NLRB and IJDB.

NLRB decisions and agreements of record that established precedent for subsequent IJDB and NLRB cases were studied. The important documents and reference sources include the Labor Relations Reporter, National Jurisdictional Agreements published by the Associated General Contractors and the Plan for the Settlement of Jurisdictional Disputes in the Construction Industry.

published by the AFL-CIO Building and Construction Trades Department. The later reference contains jurisdictional agreements and decisions of record upon which the IJDB bases the majority of its decisions.

In Phase II, the researcher solicited and organized viewpoints from contractor and union spokesmen about the voluntary and statutory resolution procedures. This data was collected via personal interviews and questionnaires with knowledgeable individuals who deal with jurisdictional matters on a full-time basis or have been closely involved with such disputes in the past. Data were gathered from three hierarchial levels as shown in Table 1-1. A total of sixty-two industry spokesman participated in the study. As can be seen in Table 1-1, there is no significant bias towards any sector or organizational level of the industry.

The principal data source was through interviews with nineteen spokesmen from contractors, trade associations, and organized labor. Those interviews included the Chairman of the Impartial Jurisdictional Disputes Board, the Assistant Director, Collective Bargaining Services for the Associated General Contractors, and the Business Manager for the Laborers' Union. Following the interviews questionnaires were sent to forty-three industry representatives twelve responses were received. The response rate was 28%. The purpose of the questionnaire was threefold, namely (1)

Table 1-1. Data Gathering Plan

HIERARCHIAL LEVEL	UNION	CONTRACTOR	DATA COLLECTION MODE	TOTAL
National	5	3	Interview	14
	3	3	Questionnaire	
Regional	3	3	Interview	18
	6	6	Questionnaire	
Local	2	3	Interview	30
	6	19	Questionnaire	
Total	<u>25</u>	<u>37</u>		<u>62</u>

gather additional information, (2) expand the sample data base, and (3) verify comments and perceptions obtained from the interviews.

The data gathered in Phase II was evaluated in Phase III. In this phase, conclusions about the practicality of retaining a voluntary resolution procedure were formulated. To validate these conclusions, they were communicated to those personnel interviewed in Phase II. Their final comments are incorporated in the report recommendations and are listed in Appendix D.



### Justification

There are many stumbling blocks encountered by an engineering manager who is responsible for completing a quality project within budget and on schedule. Jurisdictional disputes are one such stumbling block which the engineering manager must face. He must balance conflicting requirements and anticipate the consequences of his actions. His goal must be to minimize adverse impacts on cost, schedule and quality. This ability to balance, anticipate and resolve conflicts is a valuable asset for a manager.

As an engineer, the training in the application of problem-solving techniques have proven useful to the researcher in this undertaking. The ability to systematically analyze alternatives and to consider technological advances is an important asset in the study of jurisdictional disputes. The lack of responsiveness to technological changes in the construction industry is a major contributing factor to jurisdictional disputes. Therefore, it is logical that an engineer study this complex area and attempt to sort out the conflicting requirements of management and labor.

As a graduate student, one can develop independent conclusions, while being removed from job-site pressures of cost and schedule. Student status has permitted an unbiased

analysis of jurisdictional disputes as seen from the management and labor perspectives.

### Significance

The need to institutionalize conflict is apparent. Without guidelines and established procedures to direct and regulate the energies of disputing parties, strikes, slowdowns and other economic consequences are likely. Therefore, a structured procedure to resolve conflict is necessary. The NLRB and IJDB are two such approaches that provide a framework whereby jurisdictional conflicts are institutionalized.

Much time and energy has been expended to structure and operate a voluntary jurisdictional settlement organization. Evolution has led to improvements. However, one may question if the effort has been worthwhile. Are further improvements warranted or should the entire voluntary system be abandoned? Should the NLRB procedures be used instead? This report attempts to answer these questions by analyzing the current NLRB and IJDB systems.

As construction projects become more complex and costly, the uncertain consequences resulting from jurisdictional disputes are amplified. Therefore, realistic proposals for quickly resolving jurisdictional disputes is highly desirable. By examining past practices, trends,

national impact and contemporary attitudes, this report provides direction for future action for the resolution of jurisdictional disputes.

#### Literature Review Plan

A literature review revealed little published information since 1975 related to jurisdictional dispute resolution via voluntary alternative means. However, comprehensive data are available on cases brought to the NLRB. These cases are available at the Pattee Library, The Pennsylvania State University.

The Pennsylvania State Legal Library, (Harrisburg, Pa.) computerized indexing system, LEXIS, was used to determine federal court and NLRB cases on the subject of jurisdictional disputes. These cases were then evaluated for the impact on the IJDB.

The major source documents for resolving jurisdictional disputes were studied. They are the Procedural Rules and Regulations. Resolution on Enforcement Procedures for the IJDB, the Associated General Contractors (AGC) National Jurisdictional Agreements (Grey Book) and the AFL-CIO's Plan for the Settlement of Jurisdictional Disputes in the Construction Industry (Green Book). Trade publications, such as Engineering News Record provided current and past union and contractor viewpoints about the future of the

IJDB.

### Thesis Organization

The evaluation of dispute resolution procedures is presented in the following chapters. Chapter Two presents a synopsis of the causes of jurisdictional disputes as seen by the participants in the construction industry. Chapter Three discusses the functioning of the National Labor Relations Board concerning jurisdictional disputes. Chapter Four explains the Impartial Jurisdictional Disputes Board procedures when processing jurisdictional disputes. Chapter Five presents the issues involved in jurisdictional dispute resolution. Chapter Six presents the summary, conclusions, and recommendations for further research.

## CHAPTER TWO

### CAUSES OF JURISDICTIONAL DISPUTES

Before discussing the resolution procedures available for jurisdictional disputes, an understanding of the causes of the disputes is necessary. This chapter examines the apparent causes of jurisdictional disputes. The perceptions, observations and opinions of union and management officials obtained through interviews and questionnaires are the basis for determining the causes of jurisdictional disputes. Appendix B contains the names and positions of those individuals contributing to this research.

#### Jurisdictional Dispute Causes

There are many causes of jurisdictional disputes. Some of the most commonly cited causes were listed in question one of the questionnaire found in Appendix D. Table 2-1 presents these causes in descending order of importance. The discussion that follows is a synthesis of union and management viewpoints about the fundamental causes of jurisdictional disputes in the construction industry.

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 Table 2-1. Causes of Jurisdictional Disputes
 

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CAUSE		UNION RESPONSE	MANAGEMENT RESPONSE	TOTAL
1.	New materials and equipment	3	12	15
2.	Union preserving traditional work rights	5	8	13
3.	Conflict of work rights in bargaining agreements	3	7	10
4.	Subcontractor performing varied tasks with the single craft he employs	4	4	8
5.	Current economic slump	4	4	8
6.	Union expanding work rights	3	4	7
7.	Contractor seeking efficiency	0	6	6
8.	Intentional contractor misassignment	5	1	6

Numbers reflect only those respondents selecting a particular dispute cause. Listing reflects top 8 replies. Option to select dispute causes or provide no response was available. A total of 31 individual opinions were solicited

---

#### Short Term Causes

Research undertaken in 1982 must consider a construction industry in the grips of a recession (50:69). In recessionary times, there is less work and more

competition for the work that is available. Thus the economy can be considered a short-term cause of jurisdictional disputes.

The Economy. An unhealthy economic situation encourages one union to poach the work of another union. The idea is to increase the union's work volume, thereby reducing unemployment for its membership. In a healthy economy, this situation generally does not exist because there is plenty of work available. Furthermore, minor infractions of work rules detailed in the collective bargaining agreement are often overlooked during times of full employment. The converse is true when large numbers of union members are unemployed. Business agents will be very sensitive to claiming all of their normal work plus any other work that can be readily obtained. This type of encroachment leads to jurisdictional disputes.

Collective Bargaining Agreements. Another amplification of a poor economic environment can be seen in collective bargaining agreements. In an attempt to preserve and guarantee their work rights, unions will negotiate agreements that enumerate in detail the tasks that are to be performed. In the past, contractors and contractor associations negotiating the agreement have readily accepted these in the hope that explicit language will eliminate further conflicts. While this may be an effective short-

term measure, it has negative long-term consequences because it heightens the potential that the same work will be negotiated for several unions. Despite the efforts of the AFL CIO to end this practice, agreements continue to be signed with explicit jurisdictional language.

The basic concept should be to prevent inclusion of explicit contract language concerning jurisdictional rights in bargaining agreements. When this occurs, management flexibility in administering the business is reduced. Arbitration and NLRB decisions have prohibited management deviations from such explicit language, indicating that the subject had been negotiated and the contract reflected both parties' intentions. From a management viewpoint, the incorporation of explicit contract language is counterproductive to the preservation of management rights. The use of "general terms provides an acceptable alternative to more specific language" and serves to ensure management rights (Thomas, 51:466). Arbitration decisions have upheld the rights of management in cases where no explicit language was found in the collective bargaining agreement.

#### Long-Term Causes

The remaining causes of jurisdictional disputes found in Table 2-1 are related to the basic difference between unions and contractors. Union and contractor organizations both accept the free market model of competition in an



industrial society. However, the difference between the two organizations rests with the dissimilar objectives for distributing the proceeds of the construction enterprise.

Use of a Single Craft. In the absence of the need for special skills, the use of a single craft can be generally considered a normal business practice. Historically, subcontractors are noted for their attempts to minimize the number of crafts employed. For example, the prudent subcontractor will use carpenters to construct concrete forms and to place reinforcing steel. This latter work traditionally belongs to the ironworkers. If no ironworkers are on-site, then there probably will be no difficulties. However, when ironworkers are employed on the same site by the general contractor or another subcontractor, then a dispute is inevitable.

New Materials and Equipment. From Table 2-1 it is evident that the use of new materials and equipment in the construction industry is a major cause of jurisdictional disputes. To illustrate this point, consider the installation of window units. In the past, when windows were assembled in place, there was no question that a glazier was necessary to perform this specialty task. The current state of the art has seen the widespread use of prefabricated window units, and prudent business practices suggest the use of carpenters (already on-site) to set

windows rather than the hiring of another craft, namely the glaziers. The industry has been very slow to resolve these types of issues. Typically, disputes will arise repeatedly over the same issue. It may take years to resolve jurisdictional disputes over the use of new technology; many disputes have never been resolved.

Similarly, the universal shift to the installation of self-service elevators has eliminated the need for an elevator operator, a member of the Operating Engineer's Union. However, many contractors will employ an elevator operator rather than face job action by the union. There has been little adequate resolution of this and similar issues where new equipment has replaced the need for craftsmen.

Original Work Rights. Original charters and establishing documents have a great deal to do with the fostering of jurisdictional disputes. In these, the work rights of the various trade unions are established. Unions owe their existence to charters and to the early decisions of record. These documents were promulgated in the late 1800's and early 1900's and are discussed in Chapter Four. Unions have fought very hard for their rights, and understandably there is an extreme reluctance to amend these documents for fear of losing a portion of what has been gained. One example of such a historic document is

Decision No 124, dated November 11 23, 1907, concerning the operating engineers. This decision of the American Federation of Labor gives the operating engineers "jurisdiction over the motive power of all derricks, cement-mixers, hoists, pumps, and other machines used on construction work,..." (38:91). Since that time, the operating engineers have claimed jurisdiction over essentially all construction equipment and machinery.

Contractor Misassignments. The last issue considered as a causative factor is the way work assignments are made by the contractor. Sometimes the contractor will make the wrong assignment. At other times the contractor may intentionally make the wrong assignment in an attempt to circumvent union restrictive work practices, such as showup pay, minimum crew sizes, composite crews, and productivity restrictions.

### Summary

This chapter has introduced some basic causes of jurisdictional disputes as seen by management and labor. They are presented as short-term and long-term causes. The reader is referred to a study by John W. Fondahl and Boyd C. Paulson, Jr. (15) for an in-depth discussion of jurisdictional disputes and their impact on the construction industry. Chapter Three will discuss the functioning of the

National Labor Relations Board.

## CHAPTER THREE

### THE NATIONAL LABOR RELATIONS BOARD

This chapter discusses the organizational structure and functional characteristics of the National Labor Relations Board when resolving jurisdictional disputes in the construction industry. The purpose is to present the methodology and criteria upon which the NLRB decides who shall have the right to perform the contested task, the substance of a jurisdictional dispute.

#### Background

President Harry S. Truman in his State of the Union address to the 80th Congress on 6 January 1947, outlined five major economic policies he believed the Government should pursue. One major policy area was that of labor-management relations. President Truman outlined a four-point labor-management relations program. Point No. 1 of the program is applicable to this report.

President Truman proposed legislation to prevent certain unjustifiable labor practices, specifically jurisdictional matters. President Truman stated,

"Another form of interunion disagreement is the

jurisdictional strike involving the question of which labor union is entitled to perform a particular task. When rival unions are unable to settle such disputes themselves provision must be made for peaceful and binding determination of the issues (52)."

Responding to this challenge, Congress passed in 1947 the Labor Management Relations Act, also known as the Taft-Hartley Act. This enactment brought jurisdictional matters under the purview of the National Labor Relations Board(NLRB). The NLRB was reorganized to accommodate this responsibility. The NLRB was created in 1935 by the Wagner Act. This chapter discusses the applications of this legislative enactment as it pertains to jurisdictional disputes.

### Jurisdiction

The Taft-Hartley Act, in Section 8, entitled "Unfair Labor Practices," defines jurisdictional pressures and strikes as prohibited actions. Further, in Section 10, "Prevention of Unfair Labor Practices," the NLRB is empowered to prevent those unfair labor practices listed in Section 8. How this is to be done is of considerable interest.

The NLRB was authorized to receive, investigate, and rule on unfair labor charges. The enforcement powers of the

Board were also strengthened. The NLRB was allowed to petition any U.S. Court of Appeals to enforce its decision.

### Organization

The National Labor Relations Board is not charged with uncovering jurisdictional disputes, but rather the orderly resolution of such disputes. The NLRB is organized in two distinct divisions, each having specific but complementary functions. The first division is that of the General Counsel. This division is the investigating and prosecuting arm of the NLRB. The second division is a five-member board that investigates unfair labor practice cases presented by the General Counsel for resolution. This organization is shown in Figure 3-1.

The General Counsel Division is directed by a single head called the General Counsel. He directs the work of the forty-three field offices, also referred to as regional offices. Alleged violations of fair labor practices are filed in any one of these field offices. When jurisdictional matters are involved, charges may be filed by either a union or contractor.

### General Counsel

The General Counsel is appointed by the President and confirmed by the Senate for a four-year term. Continuous

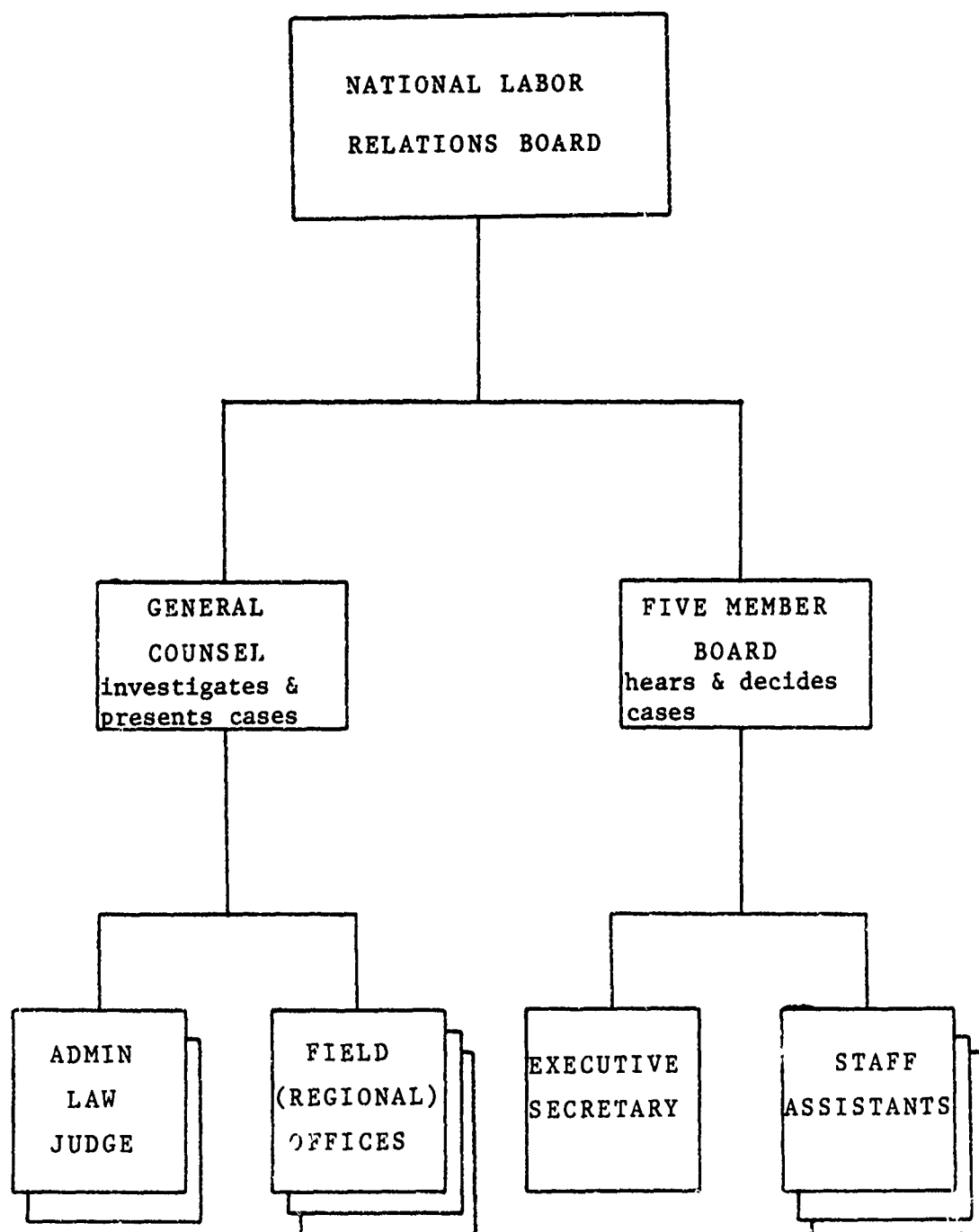


Figure 3-1. NLRB Organization



appointments are permitted. H directs the work of the GC division. The GC division was created as part of the NLRB reorganization authorized by the Taft-Hartley Act. It has two functions. The foremost responsibility is to determine if an unfair labor practice has occurred and if prosecution proceedings should be initiated. The General Counsel has the exclusive power to issue a formal complaint enumerating the unfair labor practice or to dismiss the charge. An investigation of each charge is performed by the field office and if warranted, the General Counsel forwards the case to the Board for a decision. If the complaint is dismissed, no appeal of the decision to the Board or courts is permitted. The second function of the GC is to supervise the operations of the forty-three field offices.

#### The Board

The Board consists of five full-time members, appointed by the President to serve five-year terms. Confirmation by the Senate is mandated. Reappointment to successive terms is allowed. One of the five members is designated as Chairman of the Board. The Board is vested with the authority to prevent and remedy unfair labor practices and resolve jurisdictional disputes. Any group of three members (all five are not required) is permitted to render a decision by simple majority.

Cases are decided on the basis of investigations, briefs and reports from the field offices and hearings. Rarely will the Board members request additional information to supplement the written reports.

### Jurisdictional Dispute Resolution Procedures

Unfair labor practice cases, other than jurisdictional disputes, are handled by an administrative law judge who hears and renders decisions on the merits of cases presented by the General Counsel. These administrative law judges are located in four offices throughout the country. The purpose of the five-member NLRB is then to serve as an appellate authority. The Board, on appeal, may then adopt, modify or reject the findings of the administrative law judge. A second appeal is permitted to a U.S. Court of Appeals.

Jurisdictional disputes differ from all other unfair labor practice cases. Section 10(k) of the Taft-Hartley Act specifically directs that the Board has the exclusive authority to decide jurisdictional disputes. This eliminates the administrative law judge from the resolution process of jurisdictional dispute cases. The GC presents them directly to the five member NLRB. Figure 3-2 depicts this process.

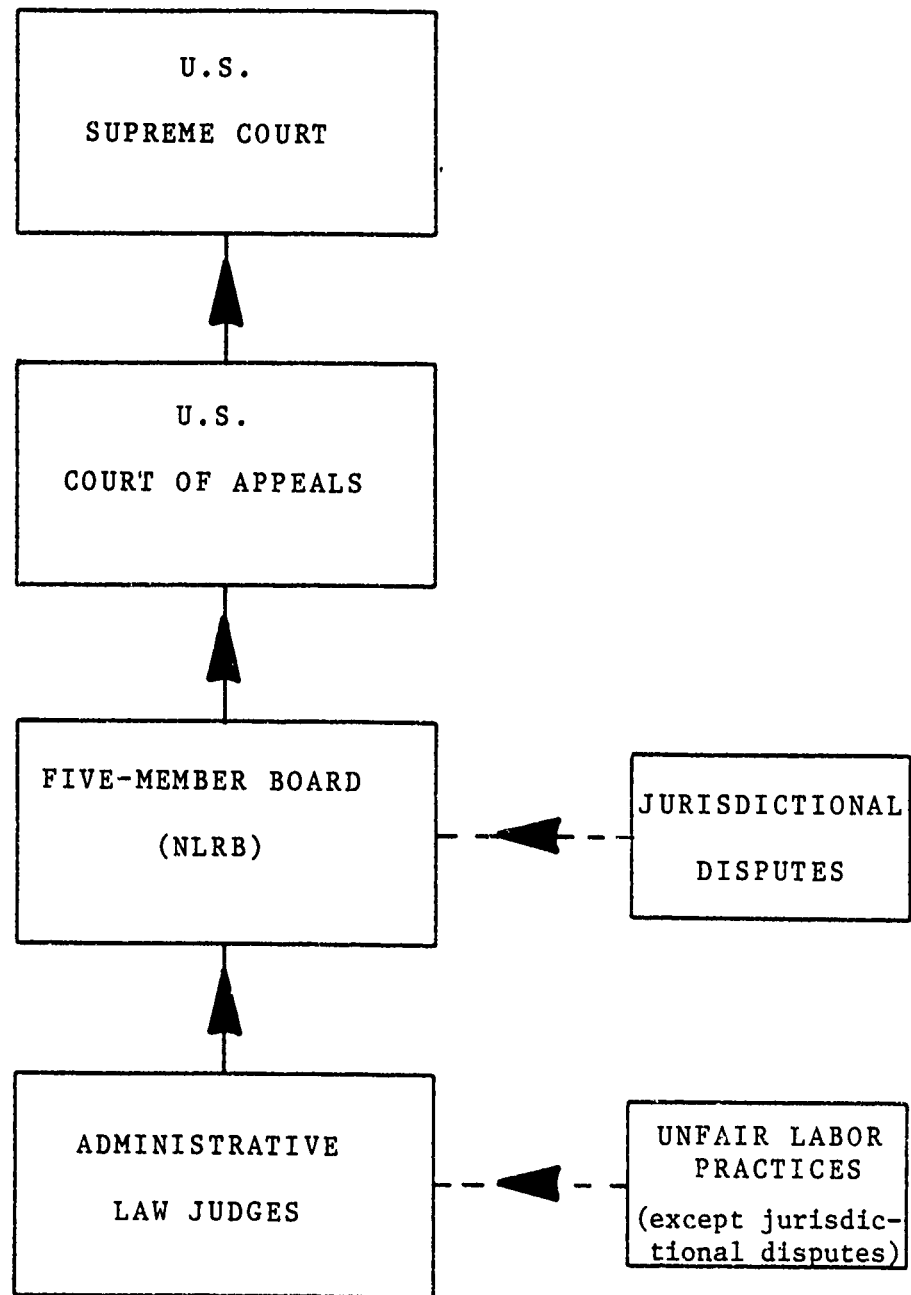


Figure 3-2. NLRB Resolution Process

### Investigation and Hearing

Once a jurisdictional dispute complaint is filed, the field office will conduct an investigation to determine the details of the case. Should the charge appear substantiated, a notice is issued to all parties, unions and contractor, specifying that a hearing will be held within ten days.

The purpose of the hearing at the field office level is to establish the specific details of the dispute. Pertinent facts are collected from all the involved parties. While the courtroom rules of evidence are not strictly applied, subpoenas, briefs, cross-examination of witnesses, entertainment of motions and verbatim transcripts are all applicable. The hearing officer, who is not an administrative law judge, analyzes the issues and prepares a synopsis of the facts. This report contains no conclusions or recommendations. The report, along with any additional legal briefs submitted by the union or contractor, is forwarded to the Board for a decision.

### Board Deliberations

The Executive Secretary receives the hearing officer's report and assigns it to the legal staff. A staff member will analyze the report, conduct additional research, and then present his findings to the Board. Seldom are all five Board members present, more typically only three members

will be in attendance. The Board reaches a decision on the basis of the hearing officer's report, briefs and research and analysis of the legal staff. A majority vote constitutes a decision.

While not an established formal procedure, the Executive Secretary attempts to assign similar cases to the same staff assistant. This procedure is an attempt to ensure continuity and consistency in the process.

#### Postdecision Actions

The party against whom the decision is rendered has ten days to comply with the Board's action. The field office that received the original charge is responsible for monitoring compliance. Following satisfactory compliance, the formal charge is dismissed. If compliance is not taken, the Board can petition the appropriate Circuit Court of Appeals to enforce its order, a process normally spanning six months to three years.

Figure 3-3 summarizes the alternative actions once a NLRB decision is issued (McGuiness, 25:307). The contractor, union, or employee, may appeal the Board decision to the Circuit Court of Appeals. The court can enforce, modify, or set aside the NLRB decision or remand the case back to the Board for rehearing and consideration of additional evidence. Decisions of the appeals court may be taken to the U.S. Supreme Court.

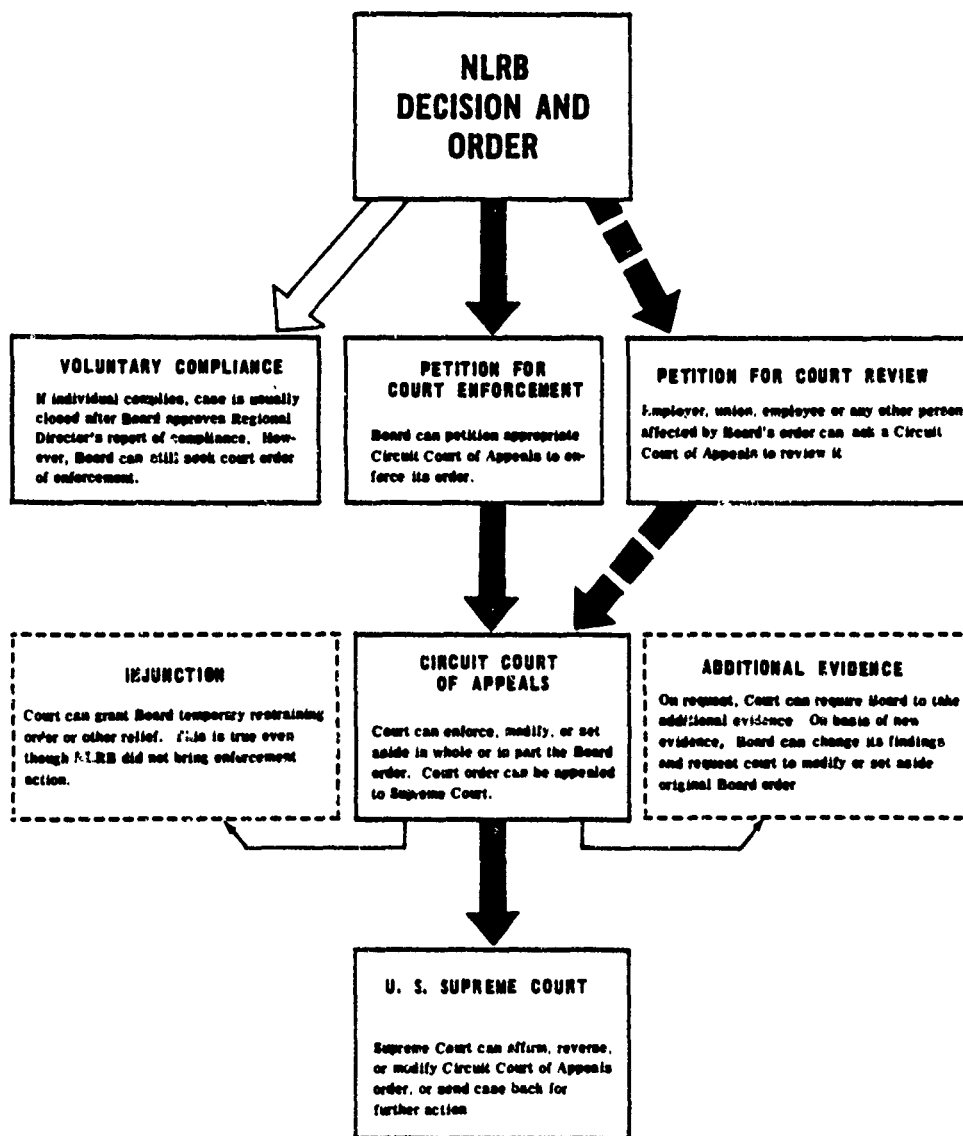


Figure 3-3. Postdecision Actions

This ability to appeal decisions to a forum not directly related to the NLRB is a significant advantage to this procedure. As will be seen in Chapter Four there is a very limited appeal process for Impartial Jurisdictional Dispute Board procedures.

### Injunctive Relief

When presenting an allegation of a jurisdictional dispute, the charging party may request injunctive relief in accordance with Section 10(1) of Taft-Hartley. If the preliminary investigation substantiates the allegation, there is evidence to issue a formal complaint. Additionally if irreparable damage may result, the field office shall petition the appropriate U.S. District Court for injunctive relief on behalf of the charging party. The normal result in jurisdictional cases is to uphold the contractors work assignment and force the unions back to work, pending a final resolution (Beckley, 2).

This avenue to the court system early in the dispute process affords the contractor an opportunity to proceed with the disputed work, free of interference. The IJDB does not contain legal remedies to ensure that the status quo is maintained during the resolution process. The IJDB can only ask the International Union to order its members back to work. If this fails, no other avenue is available.

### Time Frames

Should injunctive relief be necessary, seventy-two hours is the normal timeframe from the filing of a charge to the issuance of an injunction. The normal investigation of the jurisdictional dispute charge will take thirty to forty-five days before a hearing is scheduled.

Normally, three weeks are allowed following the hearing for the filing of briefs. The Board then receives the case. Final decisions are issued approximately six months after the Board receives the case (53). Figure 3-4 presents the typical time frame necessary to process a jurisdictional dispute case.

Since jurisdictional dispute issues normally hinder job progress, timely resolution is vital. Herein lies the major disadvantage of the NLRB. Further aggravating this situation is an already heavy caseload of numerous different types of unfair labor practice cases and personnel with no special training in the construction industry. The IJDB on the other hand, has a staff of highly trained, and construction experienced personnel. The IJDB exists for the sole purpose of resolving jurisdictional disputes. The desire to have the decision makers knowledgeable in construction was an important consideration to 23 of 27 union and management officials. The remaining four officials did not comment on this issue.



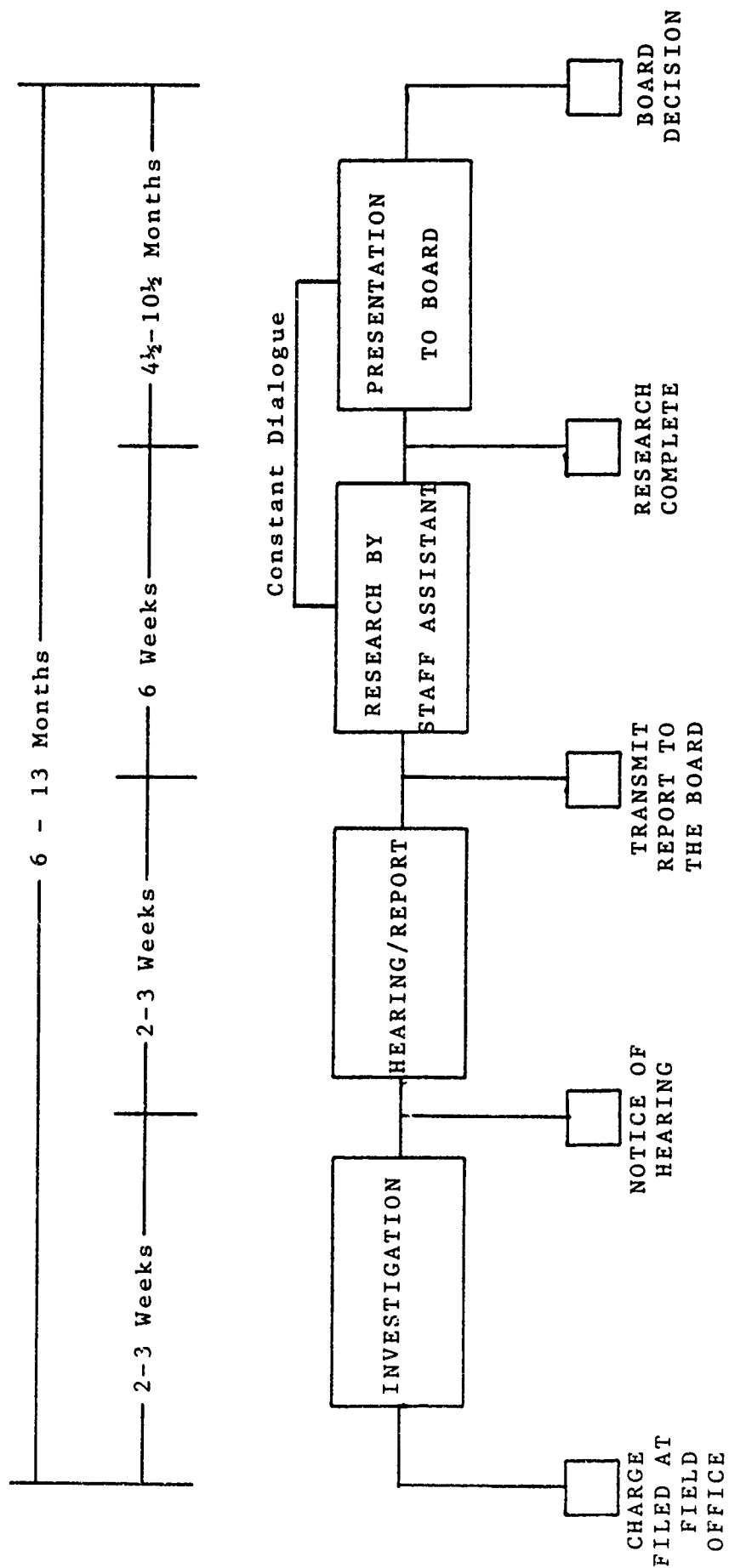


Figure 3-4. Typical NLRB Decision Time Frame

### NLRB Decision Criteria

To appreciate why certain parties are dissatisfied with the NLRB resolution procedure, one must understand the decision criteria used by the Board in reaching a decision. These are best illustrated via a case study. The first case to be discussed is NATIONAL LABOR RELATIONS BOARD v. RADIO AND TELEVISION BROADCAST ENGINEERS (33), commonly referred to as the CBS (Columbia Broadcasting Systems) case.

#### The CBS Case

Early NLRB decisions concerning jurisdictional matters were limited by the Board's reluctance to affirmatively award contested work to one union over another. Prior to 1961, the procedure followed was to determine if a contesting union was entitled to the work by virtue of a NLRB order or descriptive language in the collective bargaining agreement. However, the Board frequently upheld the employer's work assignment because there was precedent-setting information related to the above two criteria. This situation caused considerable unrest and friction among competing unions.

In 1961, a dispute arose between the unions representing the television technicians and the stage employees. The dispute was over which union should provide electrical lighting for television shows for CBS. The NLRB

decision was an acquiescence to the original CBS assignment of the work to the stage employees. The Board decision never addressed the central issue of which union was justifiably entitled to perform the work.

The case was ultimately appealed to the Supreme Court. The High Court ruled that

it is the Board's responsibility and duty to decide which of two or more employee groups claiming the right to perform certain work tasks is right and then specifically to award such tasks in accordance with its decision (33).

This landmark decision charged the NLRB with the responsibility to make affirmative awards in jurisdictional dispute cases. In essence, the Court required the NLRB to develop decision criteria.

#### Jones Construction Case

"After more than a year of self-evaluation and discussion with union leaders and employers, the Board issued its first 10(k) determinations and awards" (Player, 39:435). The precedent-setting case was the INTERNATIONAL ASSOCIATION OF MACHINISTS LODGE 1943 v. J. A. JONES CONSTRUCTION COMPANY (19). In 1961, during work for the Atomic Energy Commission at the Hanford Work Project in the State of Washington, the machinist union disputed the award by the J. A. Jones Construction Company of the operation of

electric overhead cranes in a machine shop to members of the electricians union. As a result of the CBS decision, the NLRB was now forced to develop and apply decision criteria upon which to resolve disputes. Therefore, the NLRB set forth the seven decision criteria as follows:

1. Skills and work involved
2. Previous certifications by the NLRB
3. Company and industry practice
4. Agreements between unions or between unions and employers
5. Awards of arbitrators, Joint Boards, and the AFL-CIO in the same or related cases
6. Assignment by the employer
7. Efficient operations of the employer's business

These form the basis for resolving jurisdictional disputes and are still applicable in 1982. In reaching its decision, the Board emphasized that it would not establish intransigent standards as criteria for resolving disputes. The Board affirmed that all relevant factors would be considered on a case by case basis, in no set sequence. The criteria mentioned above are not intended to be inclusive.

#### Decision Criteria

In reaching a decision, no one criterion is more important than another. Each decision is based on the subjective evaluation and judgement of the Board members. The criteria are briefly clarified in the following

paragraphs. The reader is referred to Appendix A for an indepth evaluation.

The skills and work criterion relates to which craft is better trained to perform the disputed tasks as well as the economic and social impact that an award will have on the employees. Certification by the NLRB concerns a union's right to represent workers performing certain tasks via a NLRB conducted election. Company and industry practice addresses the customary work assignments in the geographical location of the dispute. The area of agreements covers collective bargaining and interunion agreements specifying particular work rights of the respective parties.

Consideration of awards by third parties such as arbitration or alternative local settlement plans are considered when the Board deliberates a case. When these third party decision plans do not involve all parties to the dispute, the NLRB will give little weight to the results. The issue of employer assignment covers the economic considerations and preference of the employer. Finally, the criterion of efficiency considers the employer's business judgment when he initially awards the work.

#### Refusal of Jurisdiction

Under section 10(k) of Taft-Hartley, there are two instances when the NLRB is not authorized to act upon

allegations of a jurisdictional dispute. The first situation is when the parties to the dispute can present satisfactory evidence that they have settled the dispute. This must occur within ten days of the filing of the allegation.

In circumstances where the parties present evidence that they have subscribed to a voluntary alternative settlement procedure, the Board will defer settlement to this method. However, all parties to the dispute must voluntarily agree to comply with the decision so determined (32). Failure by one of the parties to agree to an alternative procedure will void the NLRB deferral.

#### Summary

This chapter has presented the organizational and functional concepts of the National Labor Relations Board for processing jurisdictional dispute cases. A discussion of the decision framework upon which the NLRB evaluates the merits and facts involved in a jurisdictional dispute is presented, as well as some advantages and disadvantages of this procedure. The two circumstances whereby the Board defers its jurisdiction are also mentioned. One such circumstance, agreement of the parties to a voluntary alternative procedure, is discussed in the next chapter.

## CHAPTER FOUR

### THE IMPARTIAL JURISDICTIONAL DISPUTES BOARD

The Taft-Hartley Act established the concept of a voluntary alternative procedure to resolving jurisdictional disputes that could be used in lieu of the NLRB. The National Joint Board for the Settlement of Jurisdictional Disputes (NJB) served this purpose until its collapse in 1969. During the period 1948-1969, few substantive changes were made to the basic operating procedures and practices of the NJB. When it collapsed it did so because there was a mutual dissatisfaction with the resolution process. The need for an alternative to the NLRB still existed. Unions and employers alike still felt a need for a voluntary system. The following year, the IJDB was created. It remained in existence until 1981. The purpose of this chapter is to describe the important characteristics of the IJDB.

#### Predecessors to the IJDB

All voluntary settlement procedures to date have relied on decisions and agreements or record as their basic decision criteria. An understanding of this concept is

necessary in order to evaluate the voluntary resolution system.

### Decisions and Agreements of Record

Perhaps the most significant characteristic of the NJB and the IJDB is the application of decisions and agreements of record as the major criteria in deciding jurisdictional disputes. The decisions of record are those job decisions rendered by organized labor since 1885 on jurisdictional matters. "These decisions are the only statements of jurisdiction binding on all the unions" affiliated with the Building and Construction Trades Department (Strand, 48:45). Agreements of record are jurisdictional accords reached between or among unions in apportioning work rights. These agreements "are binding only on the signatory unions and do not affect the claims of nonsignatory unions" (Strand, 48:45). These decisions and agreements are binding on all contractors agreeing to a voluntary settlement plan.

These records are published by the Building and Construction Trades Department of the AFL-CIO in a pamphlet entitled, "Plan for the Settlement of Jurisdictional Disputes in the Construction Industry." It is commonly referred to as the "Green Book." The problem with the Green Book is that there are no provisions for introducing new decisions.

It is from this base record of past decisions and



agreements prior to 1948 that all voluntary alternative resolution procedures have referenced when deciding disputes. Since decisions rendered after 1949 were prohibited from automatically setting national precedents without union concurrence, additions to this data base have been sluggish. Unlike the voluntary procedure, the NLRB can encompass new agreements and decisions as it chooses.

#### The National Joint Board (NJB)

Union leaders and employers have always favored an alternative to settling jurisdictional disputes through the NLRB. In establishing the National Joint Board (NJB), the founders recognized the importance of the contractor's role in making work assignments. One of the early measures undertaken by the NJB was to establish procedures for contractors to follow in making work assignments. The advantage of a voluntary procedure should be apparent. The NLRB would never be empowered to suggest to a contractor how to operate his business. The criteria for making assignments in the order of priority are:

- a. Decisions and agreements of record.
- b. Established past practices in the local area.
- c. The contractor's best judgment after consultation with representatives of the various trades.

Another important function of the NJB was to decide local issues not covered by agreements and decisions of

record. Unfortunately, the impact of this activity served to limit the scope of decisions to only those parties involved in the dispute. No review and adoption procedure was available to allow local decisions to set national precedent. Although the original objective in 1947 was to issue decisions that would be applicable nationwide union reluctance to accept the implications resulting from the proposal precluded its acceptance. The vast differences in the power of local unions to extract concessions from local employers was a major consideration. Strong unions were not about to cede any gains achieved for the sake of national uniformity. Unions were also dissatisfied with contractor involvement in areas unions previously deemed privileged. Additionally, no mechanism in the plan allowed technological changes to be incorporated into the plan as adopted. Stagnation resulted.

Another unfortunate situation was that local decisions did not normally become part of the subsequent labor agreements. This fact is still true in 1982. In an effort to minimize the uncertainties created by this situation, the NJB was supposed to encourage unions to resolve their differences by reaching national agreements. To this end, the NJB was successful (Strand, 48: 100). However since these agreements were reached very slowly, the NJB was burdened with rehearing similar cases while these agreements

were being negotiated.

In 1965, several administrative changes were made to the original National Joint Board. These changes are summarized as follows (42:65):

1. Establishment of a new Appeals Board headed by an impartial umpire to render final decisions. In the past, any appeal from a decision of the National Joint Board could be taken only to the same tribunal. This change is designed to give the unions greater confidence in and adherence to the Joint Board's determinations.
2. Protection of the interests of the consumer in the settlement of disputes by requiring that due regard be given to such factors as efficiency and economy of operation.
3. Definition of limited criteria to be used by the Joint Board in making decisions, thus simplifying decision making. The criteria are decisions and agreements of record as set forth in the "Green Book," valid agreements by the affected international unions, and established trade practices in the locality.
4. Consultation with appropriate management groups in the negotiation of jurisdictional

agreements between international unions.

The underlying reasons behind the collapse of the NJB in 1969 was its failure to apply decision criteria in a flexible manner, without rigid priorities and procedures, as well as its failure to adequately consider employer input. Nevertheless, the unions and contractors still felt a strong need for a voluntary system for resolving disputes. Over the next year, negotiations continued as the two sides attempted to reach an agreement. During this time the major points of negotiations were (1) authorization to seek court enforcement of NJB decisions, (2) increased emphasis on economic and efficiency factors in reaching decisions and (3) the revision and updating of the agreements and decisions of record.

In 1970, ten changes to the NJB were agreed upon as shown below (10:9):

1. Expansion of the board from four to eight members, and eight alternates, plus an impartial chairman.
2. Selection of board members from four industry categories: industrial, commercial, heavy and highway, and residential.

3. Identical eligibility requirements for participation in the joint board and appeals board.
4. Use of established trade practice and prevailing practice in the locality as the basis for job decisions in disputes where there is no previous decision of record or recorded agreement.
5. Recognition of consumer interest in job decisions through a new clause that reads, "Because efficiency, cost and good management are essential to the well being of the industry, the joint board should not ignore the interest of the consumer in settling jurisdictional disputes."
6. In an attempt to resolve the most serious or repetitive disputes, the chairman is authorized to appoint joint committees to try to resolve such disputes, and the hearings panel procedure has been changed to permit a hearings panel to ascertain "whether and to what extent the disputed work operations are governed by a decision or agreement of record" and to make "national jurisdictional determinations of work operations not

governed by decisions or agreements of record which shall be binding on all parties."

7. Authorization for joint board intervention wherever there is a protest over a union attempt to establish jurisdiction that deviates from the spirit and intent of the joint board agreement.
8. An agreement from employers and unions to take "all action which is legally within their power" to secure stipulations by employers to the procedures of the joint board.
9. Freedom for an employer to pursue other methods of settlement if a walkout continues for more than 48 hours after the joint board has requested the union to get workers back on the job.
10. Unions and contractors that are in noncompliance with the board procedure can no longer be represented on the joint board, appeals board or a hearings panel during the period of noncompliance

However, the Associated General Contractors of America (AGC) representing a large number of contractors/employers was not

satisfied and refused to participate in the plan. Unfortunately, the participation of the AGC was crucial, and the revised NJB was marginally successful in their absence.

### The Impartial Jurisdictional Disputes Board

The next three years saw more negotiations intended to entice the AGC to accept a voluntary settlement procedure. These led to the creation in 1973 of the Impartial Jurisdictional Disputes Board (IJDB)

The adoption of the keyword, impartial signified a significant departure from the procedures of the NJB. The IJDB made use of impartial third parties for resolving jurisdictional disputes. The goal was to preclude conflicts of interest. Additionally, a plan was included to study technological changes in the construction industry with the idea of incorporating these changes into the settlement plan. There was also a provision for the assessment of fines against individual unions who failed to abide by an established settlement plan. With these points incorporated into a new plan, the AGC agreed to participate, and the IJDB was formed on 1 June 1973.

Although the IJDB was created to correct certain deficiencies of the NJB, the central issues raised in 1970 were never resolved. Contractor and union signatories to the IJDB did endeavor to update procedures and regulations

to keep abreast of changing requirements, but agreement on the direction and substance of changes was often difficult or impossible. As a result, in 1981, union and contractor members agreed to suspend the IJDB as a voluntary alternative settlement procedure.

### Functional Aspects of the IJDB

There are three documents that govern the IJDB. They are (1) Procedural Rules and Regulations of the Impartial Jurisdictional Disputes Board and Appeals Board Procedures, (2) Resolution on Enforcement Procedures in Jurisdictional Dispute Cases Under the Plan for Settlement of Jurisdictional Disputes in the Construction Industry and (3) Plan for the Settlement of Jurisdictional Disputes in the Construction Industry, all published in 1977. The latter reference includes all agreements and decisions of record described previously. This compilation of decisions and agreements, the Green Book, was first produced in 1948 by the Joint Negotiating Committee. This committee was made up of union and management representatives. The book has remained virtually unchanged since that time. Since 1948, a few new decisions were added. New agreements are virtually impossible to add because unanimous approval of all fifteen union presidents is necessary. This process of achieving unanimous agreement occurs very infrequently.



Surprisingly, the most common disadvantage of the IJDB voiced by union (5 of 15) and management (6 of 12) alike is the reliance on the outdated Green Book. No official explicitly stated that the Green Book was an advantage of the IJDB. Most officials qualified their comments suggesting that should the Green Book be updated periodically, it would serve to stabilize the issue of jurisdictional disputes, thereby providing a ready reference to the state of the art in construction and craft jurisdictions.

#### Organization

The settlement plan has three components as seen in Figure 4-1. The first component is the Joint Administrative Committee (JAC). It is a national committee composed of eight voting members and one non voting member; four national or international union officials and four representatives from the signatory national contractor associations. The chairman is the President of the Building and Construction Trades Department, AFL-CIO. The Chairman does not vote. The purpose of the JAC is to appoint the members of the Impartial Jurisdictional Disputes Board and the Appeals Board as well as issue general guidance in the administration of this plan.

The second component is the Impartial Jurisdictional Disputes Board. The purpose of the Board is to decide cases

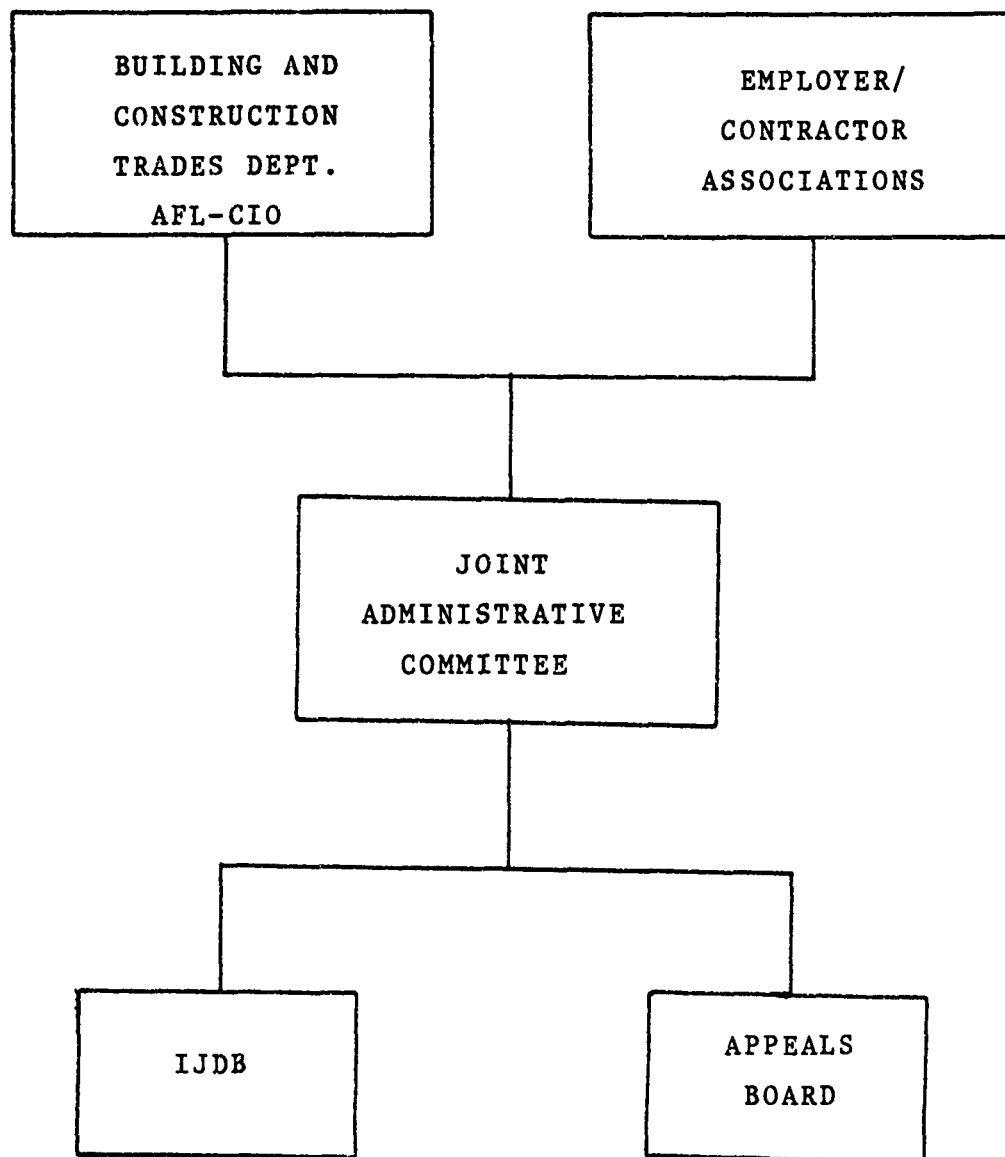


Figure 4-1. Components of the IJDB

involving jurisdictional disputes. It consists of three members appointed by the JAC for two-year terms. There is no limitation on the number of terms a member may serve. The Board is directed by a permanent chairman, also appointed by the JAC. The Chairman of the IJDB is the only full-time employee. All others serve on a retainer basis when actually engaging in their duties. The chairman serves as the Board president and votes only when one of the three members is absent. The Chairman may be removed by the JAC.

The third component is the Appeals Board. It consists of an impartial umpire and two other impartial members, all appointed by the JAC. Their function is to review appeals of decision from the IJDB. It may also review appeals from one of the approved local settlement plans (New York City Chicago, Boston). Appeals Board members serve on a retainer basis.

#### Presentation of a Jurisdictional Dispute

Under the provisions of the 1972 agreement, the contractor is obligated to make work assignments in accordance with the decisions and agreements of record or in the absence of either, to rely on local area practice. The contractor must not change work assignments as a result of union pressure instead he should request the IJDB to determine the correct union for the work assignment.

When a jurisdictional dispute arises that cannot be

settled on the project site, it may be referred to the IJDB for resolution by either the union or the contractor. The local union involved will transmit a request to its respective International Union. From there the request will be submitted to the Board. In situations where the contractor submits a request directly to the Board, he must agree to abide by the decision of the Board. Contractor associations may also submit the dispute on behalf of the affected contractor. Figure 4-2 depicts this process

Once a request has been filed, the Board will investigate the claim, using the information submitted by the disputing parties. A decision will be reached by considering specific decision criteria. This entire process is dependent upon individual contractors agreeing to submit jurisdictional disputes to the IJDB. Without this consent to participate in the IJDB, any decision reached by the Board is not binding upon the contractor. However, no such agreement to the NLRB procedure is necessary. All cases decided by the NLRB are binding upon all parties. This is a major disadvantage of the IJDB. For the voluntary process to work effectively, all contractors should agree to process disputes to some alternative resolution procedure.

#### Time Frames

Ten days is the typical elapsed time after the presentation of a dispute to the Board before the case is

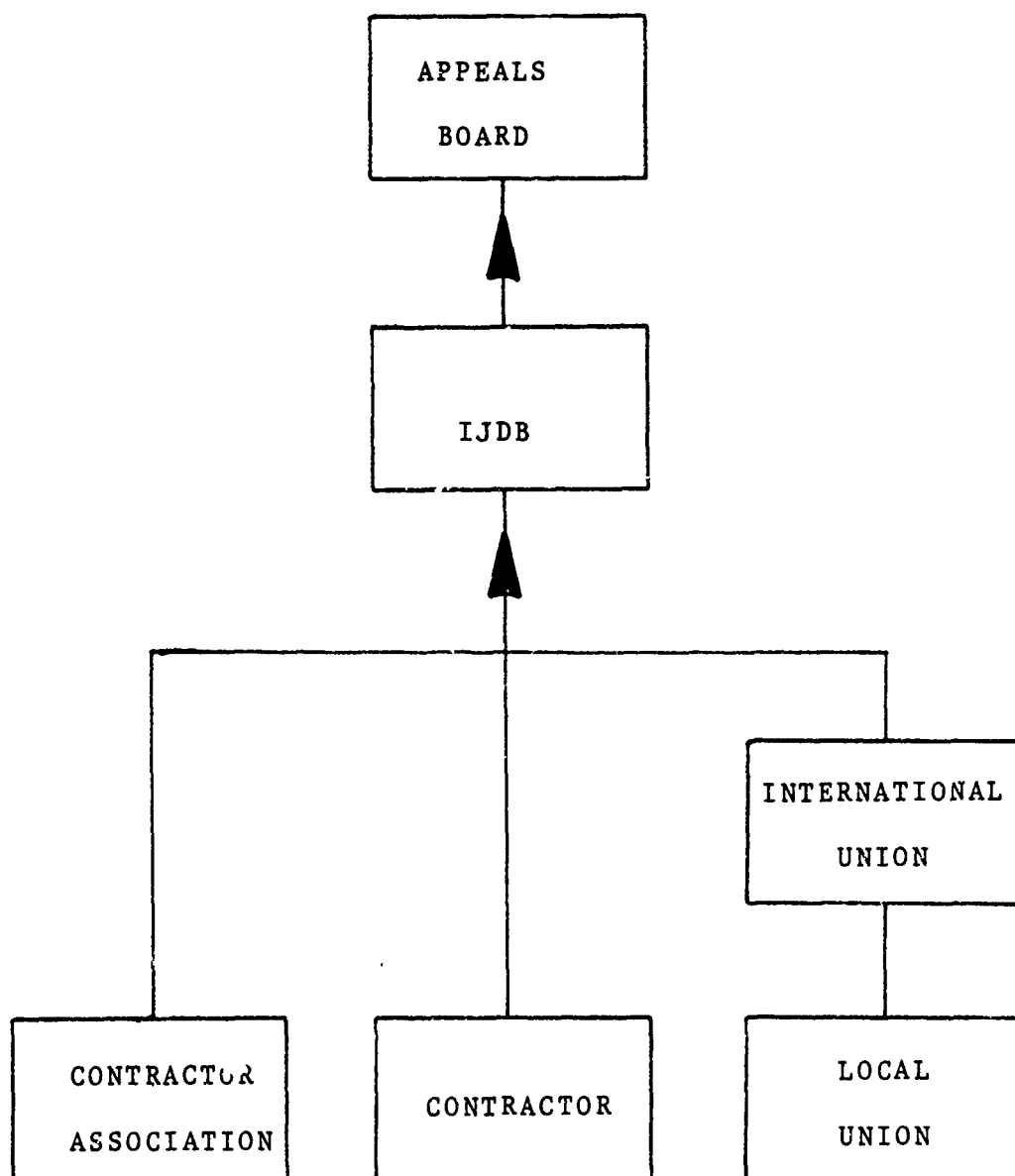


Figure 4-2. IJDB Resolution Process

decided. All requests presented to the Board by noon on Tuesday are heard the following Thursday. Decisions are normally issued the following day. Therefore, an obvious advantage to the IJDB over the NLRB is relative speed for the resolution of disputes. The time necessary to proceed from initial request for a decision to the issuance of the decision can be seen in Figure 4-3.

When compared with the NLRB time frame of 6 months (Fig 3-4) to achieve a solution, the IJDB is far more expedient in settling jurisdictional disputes. Not surprisingly, 19 of 37 union and management officials cited this as an advantage of the IJDB system. No one cited the NLRB time frame as an advantage to that system.

#### Job Decisions

Parties to this voluntary settlement plan are obligated to ensure that the work on a jobsite is not interrupted while a job decision is pending. The International Unions are expressly charged with ensuring that the local unions comply with this requirement. Should a work stoppage continue for forty-eight hours or more after notification to the Board, the contractor is released from his obligation to abide by IJDB procedures. At that point, he is free to seek other settlement procedures.

All requests for a decision must contain certain information as listed below:

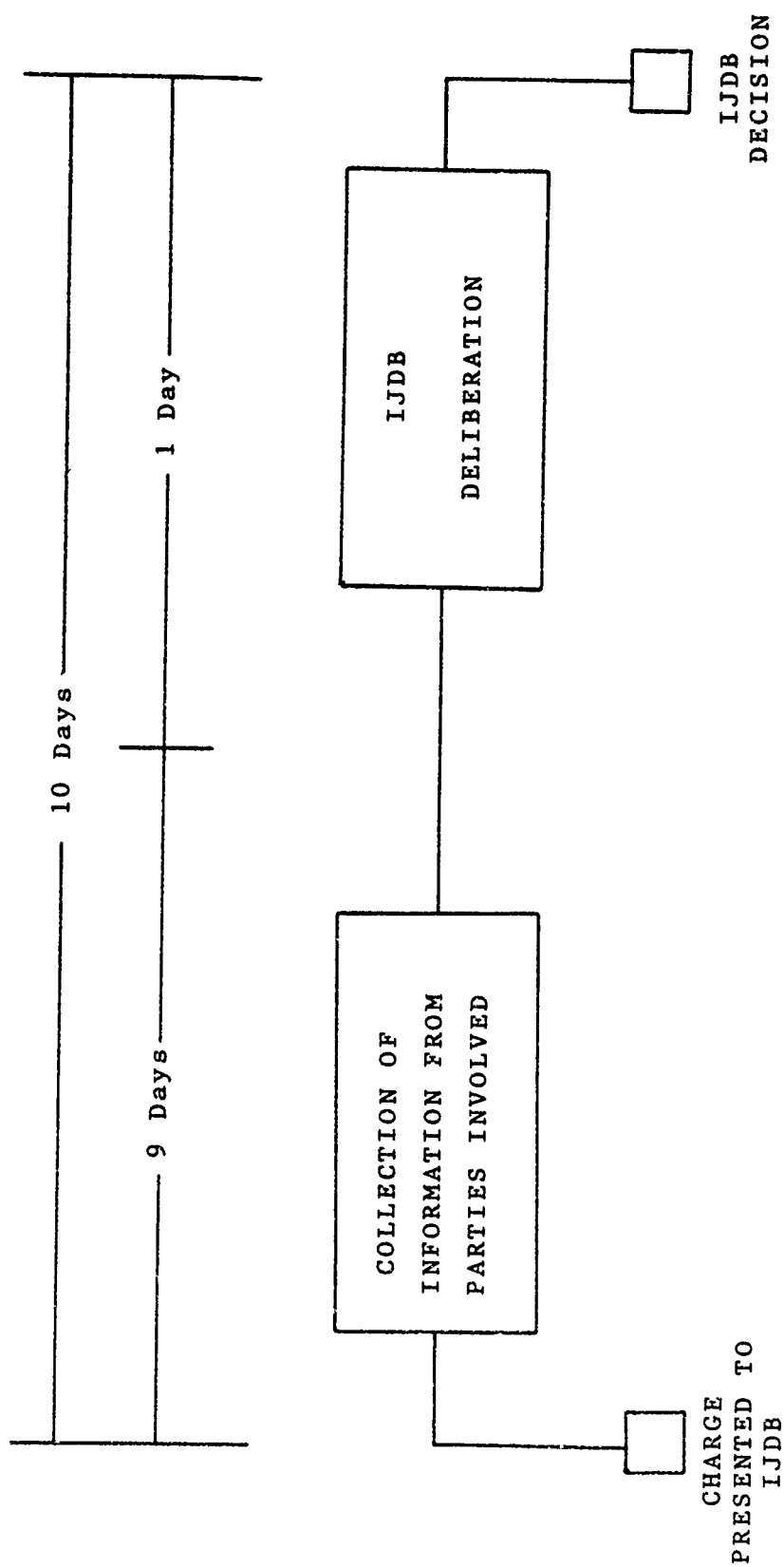


Figure 4-3. Typical IJDB Decision Time Frame

- a. Name and address of the contractors
- b. Name and location of the project
- c. Disputing trades
- d. An account of the events leading to the dispute
- e. The assignment of work made by the contractor
- f. Steps already taken to adjust the dispute. A full and detailed description of the disputed work, including pictures prints or drawings whenever possible, of the disputed work
- g. When the request is made by an International Union, it shall also state the basis for the claim of work

Once a request is filed, each party submits a written position statement regarding the disputed work. If needed, personal interviews by the Board are arranged.

#### Decision Criteria

The IJDB proceeds down a list of successive criteria in reaching a job decision. The first successful application of a criterion to a dispute precludes consideration of other factors. These factors are listed below in their order of priority:

1. Decisions and agreements of record
2. Established trade practice
3. Prevailing local practice
4. Efficiency, cost or continuity of good management

The first criterion the Board applies in all cases is



the searching of the Green Book for an applicable decision or agreement of record. If found, the dispute is so resolved. Where the dispute cannot be resolved using historical documents, the second consideration is established trade practices and prevailing local practices. Generally, this criterion covers those disputes not addressed by the Green Book.

On paper, the IJDB is not supposed to ignore the considerations of economy, efficiency, cost, continuity or good management practices in reaching decisions. These factors, however, are not considered with the same degree of importance as the Green Book records or trade and local practice when deciding jurisdictional dispute issues.

This is the most significant difference between the IJDB and the NLRB, as well as the greatest impediment to union and management agreement on a voluntary dispute resolution system. The IJDB applies decision criteria successively until the dispute is resolved. It may take only one criterion to solve the dispute in this manner. Consequently, economy and efficiency may never be considered, as they are often too far down the list of criteria. However, the NLRB considers numerous criteria simultaneously, having the potential to reach a more equitable solution through evaluation of more circumstances on the dispute.

Central to this issue is the perception on the part of unions that inclusion of economy and efficiency as a major decision criterion results in a rubber stamp of the contractor's work assignment. This was supported by the unions when they showed that the NLRB upheld 98% of the contractor work assignments in those cases heard during a five year period beginning fiscal year 1977 (Weberski, 20). From a contractor viewpoint, this is a definite advantage. Conversely, the unions view this as a significant disadvantage.

An interesting insight into the commitment to the IJDB was demonstrated by members of the Laborers' Union. The Laborers have the most to gain in taking cases to the NLRB since their members are often upheld as the most efficient and economical craftsmen to perform many work tasks. However, two officials interviewed stated their preference for the IJDB, citing the need to reduce government intervention in the construction industry, expertise of the decision makers and a desire for the construction industry to solve its own problems (4)(45).

#### Appeals Procedure

Any party may appeal a decision to the Appeals Board. The acceptance for review of a case is discretionary and the appeal consists only of a review of the official proceedings of the IJDB. Further appeal to the National Labor Relations

Board or a judicial court is not allowed.

The NLRB will review cases only if one of the parties has never agreed to accept the IJDB process. Also, the NLRB will consider reviewing an appeal if there has been serious misconduct on the part of the IJDB members.

#### Enforcement of Decisions

The IJDB is a voluntary process. As such, there is a total reliance on the good faith and integrity of the participants that they will abide by a decision. A plan to levy monetary fines against recalcitrant unions was part of the original 1973 agreement, but it has never been used. The enforcement of decisions by means of fines is further rendered ineffective because one organization voting to fine another organization today is afraid of retaliation tomorrow. This is a significant drawback to the IJDB. Its ineffective enforcement procedure has been cited by 17 of 27 union and management personnel as an area needing improvement. The remaining 10 personnel did not consider the enforcement acceptable. The NLRB's ability to enforce compliance with decisions through the courts, if necessary, has been referenced as a definite advantage over the IJDB.

#### Repetitive Disputes

The Board is charged with maintaining a record of decisions. These are organized by type of dispute and trade

union. If a pattern can be established the Joint Administrative Committee (JAC) is empowered to authorize the Impartial Chairman to issue immediate job decisions should similar cases arise. In this way, the time necessary to issue a decision would be reduced. Should a union or contractor be dissatisfied with the Chairman's ruling, he may request a full Board hearing.

In those instances where the JAC declares that a dispute is repetitive, the corresponding International Unions have ninety days to formulate a new agreement of record on the issue. Should they fail to do so, the JAC is authorized to convene a Hearing Panel to settle the issue for the Internationals. The subsequent decision is final and binding on all parties.

Although the IJDB addresses this area, it has failed to take action to implement this procedure. Six union and four contractor representatives cited this as a disadvantage to the IJDB.

#### Technological Changes

The JAC is empowered to establish a committee of union and contractor representatives to review the impact of technological changes in the industry on existing agreements. Typical areas to be addressed include new construction materials, equipment, methods, and procedures.

The goal of this process is to permit the JAC to adjust

the settlement plan to reflect the current status of the construction industry. In theory, this will enable the IJDB to efficiently resolve jurisdictional disputes as the industry changes in the face of new technology. The IJDB's inability to utilize this organizational machinery to keep abreast with changes in the industry is seen as a disadvantage to the procedure by both union and management leaders.

### Local Settlement Plans

When the Taft-Hartley Act was passed, there were three strong and effective local jurisdictional dispute settlement plans in existence. As a result, provisions were made to exempt these plans from being superceded by the new national plan. The special status granted these plans has remained in effect since 1948.

### Summary

This chapter has discussed the evolution and functioning of the voluntary alternative settlement procedures for jurisdictional disputes. The decision criteria and their application were discussed. Because the procedure is voluntary, unions and contractors must, by their own volition, submit their disputes to, and be bound by, the decisions of the IJDB. Refusal by either party will

negate this approach. Chapters Five and Six will discuss the major issues involved in determining the future of voluntary settlement procedures.

## CHAPTER FIVE

### ISSUES BEARING ON ALTERNATIVE SETTLEMENT PROCEDURES

Chapter Five presents the barriers to the successful adoption and functioning of an alternative dispute resolution procedure such as the IJDB. Needed changes to the IJDB that are prerequisites for its continuance will be discussed.

#### Procedural Characteristics

From interviews with union and management personnel concerning how to solve the jurisdictional disputes resolution problem, there is surprising agreement on many of the key issues. Both sides support the need for an alternative settlement procedure to the NLRB. Frequently, the alternative suggested to the NLRB is the current IJDB, or a revised version thereof. The major issues facing the industry are as follows:

1. Change to Decision Criteria
2. Enforcement Authority
3. Stipulation
4. Scope of Application
5. Precedential Authority

### Observations

The greatest stumbling block to a voluntary alternative to the NLRB is a reluctance of union officials to adopt change to the decision criteria upon which jurisdictional disputes are resolved. This emerges primarily as a disagreement over application of the Green Book in dispute resolution. Contractors cite the Green Book as it currently exists as a substantial impediment to improving the IJDB or structuring a new procedure. As reported in Engineering News Record, the Associated General Contractors have withdrawn from the IJDB, citing a failure of new proposals to substantially remedy past deficiencies (1:98).

In 1969, the NJB collapsed because contractors felt a need for substantial changes in the jurisdictional resolution process. However, the IJDB that emerged in 1971 reflected little substantive changes from past practice. During the decade of the 1970's, the reliance on the decisions and agreements in the Green Book has remained unaltered. These and other problems are discussed in the following sections.

### General System Characteristics

A definite consensus exists among union and management leaders regarding the need for a voluntary dispute



resolution procedure (18 out of 21 responses favored a voluntary system). Most parties want a procedure that is: (1) fair, (2) equitable, (3) expedient, (4) consistent, (5) enforceable, (6) administered by individuals with knowledge of the construction industry, and (7) free of government influence (unanimously supported by 12 officials interviewed).

Some union and management officials suggest that the IJDB is capable of meeting all seven criteria. The procedural rules of the IJDB as written, reflect all criteria. However, a breakdown results in the actual functioning of the IJDB during implementation. The participants have expressed the opinion that changes to the system are needed. An excellent example is the ability of the IJDB to fine member unions to enforce decisions. This supports item 5 above, but has never been invoked by the IJDB to enforce its decisions.

While conducting this research, the parties involved frequently discussed the functional aspects of the NLRB and IJDB covered in earlier chapters. Both sides agree on the broad issues, but disagree on the implementation of the aforementioned seven criteria. Therefore, since agreement exists on the general characteristics necessary to the functioning of a voluntary resolution procedure, the next step is to reach an agreement on the administrative

implementation of the characteristics.

### Major Issues Involved in Dispute Settlement

The largest stumbling block to recreating some variation of the IJDB or new alternative to the NLRB is the reluctance of union officials to adopt change to the past decision criteria, namely the reliance on decisions and agreements of record. Each side must be willing to intelligently discuss this and other issues presented below in order to bring about changes to the currently suspended IJDB. In previous chapters it was noted that no substantive change was ever made to the NJB or IJDB as originally drafted in 1948. This reluctance to change has essentially involved the application of decision criteria in resolving jurisdictional disputes. Some agreement on a new set of decision criteria is needed for the success of a voluntary alternative to the NLRB.

Enforcement Authority. Of the 19 parties interviewed, all felt that a successful resolution procedure must be enforceable. Voluntary compliance is ideal, but some mandatory enforcement procedure or penalty for noncompliance is probably needed.

The IJDB approach has provisions to levy fines against unions for non compliance, but the procedure has proven to be ineffective. This is largely because the procedure for levying fines applies only to member unions and not to

contractors. Any new procedure must incorporate a process whereby a third party will ensure compliance. Enforcement through the court system would appear to be the most viable alternative. This method has proven effective in other areas and is not without precedent. For example, arbitration procedures of the American Arbitration Association are enforceable through the courts. Either party to the proceedings should be able to seek court action.

Stipulation. One of the major problems with the IJDB is that while the unions are bound to use the IJDB and to abide by the resultant decisions, contractors are free to take disputes to the NLRB if they choose. If the union takes a dispute to the IJDB, the contractor will abide by the decision only if he wants to or has previously agreed to abide by IJDB decisions. This inconsistency has caused considerable animosity between labor and management. Data gathered during this research effort shows twelve out of thirteen union officials support contractor stipulation to the IJDB while only five out of eleven contractors support this idea. Contractors are reluctant to agree to be bound to decisions issued by a procedure that does not consider their business interests in rendering decisions. It appears that the consideration of economy and efficiency must be incorporated as one of several dominant decision criteria,

in order to achieve a workable procedure.

Under the current IJDB procedures, trade organizations (AGC, NCA) do not have the authority to bind their members to some settlement procedures. In the event that a new alternative resolution procedure is adopted by the trade associations and unions that places less weight on the past and more on the business considerations of contractors (economy and efficiency), then the trade associations should have the authority to commit its membership to the plan.

Contractor stipulation can be compared with the American electorate in a representative democracy. The people (contractors) elect (choose) their representatives (contractor associations) to present their views and decide the issues on their behalf. Chaos would reign if every citizen was personally involved in each issue considered. This is just what has happened to the IJDB. The stipulation issue of contractors is a contributing factor to a fragmented construction industry as observed by Janet Rossow and Fred Moavengadeh (43:278).

Scope of Application. Decisions reached by the IJDB apply only to project in question, whereas the NLRB decisions apply nationwide. In order to stabilize a fragmented, dispute-prone industry, uniform nationwide application of decisions is highly desirable.

Far from a popular position, this would establish

uniform standards in all parts of the country. Resistance to this proposal would be expected from areas of union strength, such as New York, Boston, Chicago and St. Louis. In these areas, unions have generally been successful in negotiating concessions from management during collective bargaining. Of the seven union representatives who commented on this idea, all supported the concept of a uniform scope of application, at least applicable in a defined geographic (regional) area. The unanimity of the affirmative responses was not expected and suggests that opposition from union officials may not be as strong as many perceive. Two contractor representatives suggested that a national precedent would serve larger contractors since they work nationwide. No other contractors voiced an opinion on this issue. This would enable them to standardize work practices. Another comment voiced by the AGC was that this type of universal national policy on decisions may help to solve the fragmented state of the construction industry.

Provisions could be made to phase new national decisions into local areas in order to mitigate the impact. The potential for achieving long-term gains through short-term sacrifices in changes to local practice is evident. Union and management agree on the concept of decisions setting precedents. The common ground is that of regional

applicability. However, uniform national practices that are supported by the union presidents and contractor associations is best in fostering long-term industry stability. Any dispute resolution procedure must not develop solutions based upon arbitrary criteria. One successful way to render decisions in an organized manner is the precedential authority used by our judicial system. Previous decisions are given substantial weight in determining the outcome of present events. As new facts are accumulated and circumstances change, precedents yield to new interpretations and decisions. This procedure produces a systematic and consistent basis for resolving disputes while maintaining the flexibility to change.

Those union and management personnel interviewed agree unanimously that decisions must not be arbitrarily reached. Systematic consideration of some agreed-upon criteria must be incorporated in the resolution procedure. However, each official had a different opinion on how much influence a past decision or agreement should have on disputes presently being resolved. Unions desire that each case be decided individually and expeditiously. Contractors desire each case to be decided expeditiously and consistently. Therefore, in order to compromise and achieve both goals, a procedure to rapidly apply current facts and occurrences to past situations, where possible should follow. This is in

effect, the precedential system used by our judicial system.

Decision Criteria. In the discussion of issues bearing on jurisdictional disputes, the actual decision criteria to be used is the most controversial. The opposing views center on the degree of reliance on the Green Book (decisions and agreement of records) versus the application of economy and efficiency.

The unions unanimously place the Green Book in the top third of those decision criteria necessary for the resolution of jurisdictional disputes (see Appendix D). Only when no applicable decision can be found in the Green Book should another criterion be applied. This is true because the unions wish to preserve rights won in past decisions. By insisting on applying these past decisions and agreements of record to current disputes, they guarantee that their work rights will be preserved. Contractors want to place more emphasis on their preferences, which are economy and efficiency, as the main decision criteria. However, contractors realize that economy and efficiency should not be the only criteria. In essence, these differences reflect the opposing roles and objectives of political (union) and business organizations (contractor).

When discussing various decision criteria, some officials feel that numerous criteria should be applied to the dispute as an aide in reaching a decision. Others

suggest that a priority listing of criteria be formed and each one applied individually until one applies to the dispute in question. The most often suggested decision criteria which are a combination of those used by the NLRB and IJDB are:

- a. Bargaining Agreements
- b. Skills of workmen and tasks involved
- c. Industry custom and practice
- d. Decisions of record
- e. Agreements of record
- f. Efficiency and economy
- g. Prevailing local practices
- h. Established trade practice

Three out of five union officials support the idea of using all of these criteria in reaching a decision while only two of seven contractor representatives support this suggestion. Among the unions interviewed, the feeling was that compromise would be traded for recognition of certain work rights. Unions feel these work rights are threatened when decisions are made on the basis of economy and efficiency. However, contractors stress the need to remain competitive in the marketplace and the need to award work based upon sound business practice, not decisions and agreements of record from the early 1900's.

An example of this would be the established work right that requires carpenters to erect scaffolding over 14 feet in height. This was an economical and efficient practice when scaffolding was constructed of wood, requiring custom



building. Current scaffolding is constructed of reusable metal components such as tubular steel piping. Economically, lower paid workmen, such as laborers are a better choice to erect the scaffolding. All the parts are standardized and erection is much like a child's erector set. Therefore, the need for skilled carpenters to erect the scaffold is no longer necessary. However, past decisions and agreements have prohibited a change in this practice.

Contractors, however, recognize the union position of wanting to retain tasks they have worked hard to obtain in the past. Therefore, a compromise on the major issue, the Green Book, is indicated. A suggestion would be to update the Green Book to account for changes in the industry to reflect the practices of the 1980's. It could then serve union and management as one of the eight decision criteria. Less than seven of the nine contractors interviewed would oppose using the Green Book as one of the decision criteria if the book was updated to reflect the current status of the construction industry.

### Recommendations

The recommendations that follow are divided into two areas. The first recommendations concern what the researcher feels should be the broad framework of principles

upon which future negotiations should proceed for a voluntary alternative to the NLRB. This should serve as a starting agenda for union and management negotiations. The second area addresses specific changes to the IJDB that are needed to make the IJDB work.

#### General Guidelines

The National Construction Employers Council (NCEC), on August 20, 1981, set forth seven basic principles upon which to structure a jurisdictional dispute resolution procedure. These are as follows

1. A panel of three to five current unaffiliated public members should be appointed by the parties to the plan. Both retirees from the construction industry and qualified individuals outside the industry would be eligible for appointment.
2. Decisions of the panel should be made pursuant to agreed-upon broad guidelines providing for flexibility and change.
3. Decisions of the panel should establish precedent, subject to future change as facts, circumstances, or technology change. Such decisions would be made on the basis of

jurisdictional trade "blocks". A block would consist of related craft areas such as metal (including ironworkers, sheetmetal workers, boilermakers, elevator constructors) mechanical, wood and related surfaces and the service oriented trades. Once the appropriate "block" has been determined, the contractor's assignment of work to any union within that "block" shall be reinforced by panel decisions.

4. A contractor should have input and involvement at any point in the decision-making or dispute settlement process. The employer's assignment may not be changed without his agreement or until the panel has reached a decision.
5. Any craft which strikes or otherwise stops normal work over a jurisdictional dispute shall have no further claim to the work on that project.
6. There must be an effective enforcement mechanism.
7. The plan should be designed so that all employer associations would agree to stipulate, and all contractors would also want to stipulate. The panel would not consider a

case unless all parties are stipulated.

These principles should form the basic issues management and union must negotiate. Three of four unions agreed with this proposal, it was accepted by all four responding contractor representatives.

Study of the New York Plan for the Settlement of Jurisdictional Disputes (Appendix C) should be initiated to define functional concepts that can be applied to a national dispute resolution system. As a local plan, it has functioned well since 1903, with virtually no changes. The NYC plan has as its a cornerstone, union and management support and trust of one another. Other qualities that have sustained this local plan should be investigated. Some of the functional aspects of the NYC plan worth investigating are.

1. Initial settlement attempts on the job site
2. Mediation settlement, only binding on the job in question and decided solely by union representatives
3. Arbitration settlement, which sets a precedent for the entire NYC area and can be enforced in the courts: only management representatives are permitted on the arbitration panel

There appears to have been too much effort and

attention focused on minor repairs to the old NJB system when a major overhaul was really necessary. It is felt that a new effort, embracing the seven NCEC principles and careful study of a current functional local settlement process spanning some eighty years can yield insight with potential gain for long-term benefits at the national level.

#### Specific Recommendations

The currently suspended IJDB has been cited by some union and management officials as an adequate system. It is concluded that if modified, the IJDB will be effective. These suggested modifications are:

1. Decisions should be enforceable through the courts
2. Contractor associations bind union contractor members to the settlement procedure
3. Decisions set national precedent; can be overruled by unions signing a new agreement of record or precedent changed by future decisions
4. Updating the decisions and agreements of record in the Green Book
5. Combine NLRB and IJDB decision criteria with provision for each criterion to have an

individual weight (relative order of importance). Each criterion would be considered, but not carry equal weight. The process would resemble a simple scoring model (Cleland, 9:348)

6. Provision for appeal and review of decisions to an impartial committee which should function as a Supreme Court

Recommendations 1-4 and 6 are generally supported by all four union representatives that were interviewed. Of the four contractor representatives responding, all generally supported recommendations 1, 4, and 6. Three of the four management officials disputed items 2 and 3. As for recommendation 5, the general weighting concept was supported, although differences of opinion as to which criteria should be considered was evident.

### Summary

This chapter has covered the positions of union and management on resolving jurisdictional disputes. Also discussed were the major issues involved in the union and management positions. Finally, recommendations towards achieving a workable voluntary alternative to the NLRB were presented.

## CHAPTER SIX

### SUMMARY AND CONCLUSIONS

This chapter discusses the conclusions, recommendations, and areas for further study on the subject of jurisdictional dispute resolution. Throughout this research effort, the underlying opinion of most participants is that there is a need and willingness to adopt some, if not all of the suggestions presented in this thesis. However, each party is on the defensive and unwilling to take what is perceived to be an unpopular position on concessions or compromises.

This thesis has determined that a mutual basis of understanding does exist upon which management and labor can structure an alternative resolution procedure to the NLRB. The major issues affecting this procedure were explored and suggestions and recommendations discussed. It is hoped that this material will contribute to the recreation of a new IJDB as well as help reduce some of the contributing factors to this dispute-prone and fragmented industry.

### The NLRB

The NLRB was assigned the responsibility for jurisdictional disputes in 1947. In the ensuing years, there have been modifications to its powers, scope and procedures. Nevertheless, the NLRB has continued to fulfill its purpose.

#### Pros

The NLRB is often viewed as pro-management because of the high percentage of decisions favoring contractor work assignments. This favoritism predominates because the NLRB gives substantial weight in reaching decisions to the criteria of economy and efficiency of operation; a prime concern of a successful and competitive business enterprise.

Also, compliance with decisions can be enforced via court order if necessary. Delay tactics or the disregard of decisions can lead to injunctions and contempt of court proceedings.

#### Cons

Jurisdictional disputes are costly to contractors and owners. The NLRB has not been successful in resolving these disputes expeditiously nor in minimizing monetary losses. Typically it takes six months from the filing of the original dispute until it is resolved. Union and management alike view this as unacceptable. Time is of the essence.



Jurisdictional disputes are only one of the many types of cases the NLRB must decide. The NLRB gives jurisdictional cases a high priority when scheduling them for action. However, this priority system is not as expeditious as the IJDB, nor is the attention of the hearing panel focused on just one case. Many varied cases are handled simultaneously. Usually the personnel assigned to resolve the dispute are not knowledgeable of the construction industry. Union and management opponents of the NLRB have cited this as a severe drawback to its use.

Unions dislike the NLRB because the decision criteria gives little weight to trade practices, original charters, and past decisions and agreements of record. These criteria often conflict with management concerns for economic and efficient operations. Historically there is less than a 10% chance that the NLRB will reverse the original work assignment by the contractor.

#### Alternatives to the NLRB

The first non-governmental procedure originated in 1948. In the intervening years, modifications to the original plan led to the IJDB that was suspended in 1981.

#### Pros

The IJDB has many advantages as noted in Chapters Three and Four. Expeditious decisions and construction-

experienced staff, qualified to appreciate, consider, and rule on the nuances of construction operations are advantages recognized by both management and labor. The two most notable advantages of the IJDB over the NLRB are (1) the speed with which decisions are rendered and (2) the construction experience of the staff responsible for settling the dispute. Management and labor alike strongly agree that these two characteristics of the IJDB are essential.

The decision criteria used in reaching a decision is the foremost point of disagreement between management and labor. Unions view the reliance of the IJDB on historical decisions and agreements of records (Green Book) as a significant advantage. Management would also recognize this as an advantage should the Green Book be a reflection of new technology and competitiveness that are the characteristics of the construction industry in the 1980's.

#### Cons

Depending upon the individual discussing the issue, the Green Book can be considered as an advantage or as a disadvantage. However, if the Green Book were updated periodically, most of those interviewed would consider it an advantage, and support its inclusion as one of the decision criteria to be used by an alternative to the NLRB. Lack of enforcement powers is also an important issue where the IJDB

is currently deficient. A procedure to ensure compliance with decisions rendered is necessary.

### Industry Perceptions

Based upon this research effort, there are more areas of agreement between management and labor than there are differences. Each side appreciates the position of the other yet each does not want to bargain from a position of apparent weakness by offering concessions or compromises. Resistance to change has proven to be the stumbling block to alternative settlement procedures since 1948 when the first procedure was conceived.

### Management

The position of contractors can be described as practical. A voluntary resolution system must operate within general principles that serve to preserve management rights and support sound business practice. With this accomplished, the necessary management support to make such a plan of rate will be forthcoming. The AGC has supported this position by its endorsement of the seven NCEC principles discussed in Chapter Five (46).

In the competitive construction industry, contractors find it difficult to overcome a strike or job action especially over jurisdictional matters (17). Even those of short duration or limited scope may cause the contractor to

incur serious economic hardships. To survive, the contractor frequently responds to union pressure in making job assignments. Strength dominates. This may also lead to unions fighting among themselves over work rights, with the contractor being the innocent vic'im. This situation is directly related to the issues of original work rights, charters and competition for work and membership. The unions must realize that contractors are essential to the employment of their membership as well as their very existence.

Mr. Dale Gemmill of the Keystone Building Contractors Association suggests that "if unions don't put their house in order, the construction employer will operate in a manner, . . . , where his employees will perform any type work on a project" (16). He believes that unions must become more cognizant of the efficiency and economy of the work and adapt the past to preserve the future. Otherwise, union contractors and, hence, the need for union labor will diminish. His views are shared by many other management leaders.

### Labor

Several interesting attitudes emerged during the analysis of labor perspectives. First, many felt that the international presidents must consider the thoughts of the subordinate union leadership and force the Building and

Construction Trades Department to redefine their craft jurisdictions. Although not unanimously supported, four of six union officials who commented on the idea believed this type action was necessary. Interestingly, two supporters were international representatives. A second view expressed was that the historical perspective of holding onto the past is becoming obsolete. Three of five union representatives suggested that the Green Book as the major source of determining craft jurisdiction may have a limited future. Other union officials were not as explicit on this matter, however some did indicate this view was gaining support.

Mr. Henry T. Doherty, Jr. of the Harrisburg and Central Pennsylvania Building and Construction Trades Council expressed a very perceptive observation on the state of union affairs. All concerned parties must realize that what was good practice in the 1950's and 1960's is not necessarily good for construction in the 1980's. What was labor intensive in the 1950's is no longer so. The increased use of prefabricated and modular construction today has created a shift in trade organization tasks (14).

Union officials inferred that a need for change is prevalent at local and regional level and recognized at national level. Identification of areas and practices that are in need of change is necessary. Action to implement the necessary improvements should logically follow. However, it

Is this researcher's opinion that the current union position in the face of diminishing work is to preserve the tasks each union has historically performed. Therefore, officials only infer the need for change and are reluctant to take positive steps to improve the status quo.

### Recommendations

The recommendations for resolving the issue of jurisdictional dispute settlement procedures are divided into two areas: (1) short-term actions, and (2) long-term actions. Figure 6-1 enumerates these recommended actions.

#### Short-Term Actions

First, the original parties to the IJDB must reaffirm their commitment to making the procedure work. Without this, no accord will be reached.

Second, no job should be started without a prejob conference in which jurisdictional issues are among the major items discussed. This is practiced by H. B. Alexander and Son, Inc., of Harrisburg, Pennsylvania, and appears to serve the useful purpose of addressing potential problems before they reach crisis magnitude (18).

Third, each side must make a commitment to compromise and accept changes as necessary to achieve two goals: (1) preserve the existence of union contractors and unions through sound business practices and (2) affirm the

- 1- COMMITMENT TO VOLUNTARY PROCEDURE
- 2- PREJOB CONFERENCE
- 3- PARTIES AGREE TO PRESERVE UNIONS AND UNION CONTRACTORS AND TO DESIGN A SYSTEM BINDING ON ALL INDUSTRY PARTICIPANTS
- 4- BUILDING & CONSTRUCTION TRADES DEPARTMENT REDEFINE CRAFT JURISDICTIONS
- 5- IJDB HEAR ALL CASES FIRST
- 6- BI-LEVEL APPEALS: FIRST TO THE JAC; THEN TO A RESTRUCTURED NLRB SERVING AS A SUPREME COURT
- 7- OWNER INVOLVEMENT--ADDRESS HOW DISPUTES ARE TO BE RESOLVED IN THE CONTRACT DOCUMENTS
- 8- NEW VOLUNTARY ALTERNATIVE HAVE FEATURES OF:
  - Decisions are court enforceable
  - Universal stipulation
  - Decisions set national precedent
  - Apply weighted decision criteria
  - Bi-level appeal procedure
  - Expeditious procedure--72 hours
  - Penalties for job action
- 9- REVISE GREEN BOOK
- 10- REVIEW LOCAL SETTLEMENT PLANS (ie NYC) FOR NATIONAL APPLICATION

Figure 6-1. Recommendations for Future Action

commitment to design a fair, equitable, and enforceable resolution system, that is binding on all construction participants.

### Long-Term Actions

The international union presidents have already yielded their authority to the Building and Construction Trades Department, AFL-CIO to determine national craft jurisdiction on their behalf. The presidents must now charge the same AFL-CIO Department with the task of redefining the work rights of each union for the 1980's and beyond. Only by an assessment of the past and acceptance of the present will the future be secured. This is a necessary first step.

Second, the NLRB should establish a precedent that will force all jurisdictional cases to first be heard by the IJDB or a similar procedure set up by the construction industry. The decisions rendered would be subject to appellate review if one of the parties so requested. The procedure would model the current judicial appeal system.

The first appeal (review) would be by the Joint Administrative Committee. They would review the original decision of the IJDB for proper procedural considerations. In the absence of new, relevant facts or gross procedural errors, the decision would stand unaltered.

A second level appeal, similar to the Supreme Court, would be allowed. A restructured NLRB would serve this



function. The NLRB must be viewed as impartial by both sides; not partisan as it now functions. Continuity would be institutionalized by requiring all levels to decide and apply the facts of the dispute to the previously referenced weighted decision criteria.

Third, the owner must become cognizant that jurisdictional disputes impact on the quality, cost and schedule of his project. The issue can no longer be considered the sole problem of the contractor. It is to be shared by the owner as well. The Business Roundtable has suggested that the owner consider the contractor's plans for handling labor-management problems as one criterion upon which to award a construction contract (6:21). This is a deviation from the traditional approach whereby labor relations are left to the contractor. It may be in the owner's best interest to specify in the contract documents (special conditions) the organization entity where jurisdictional disputes should be resolved.

Fourth, a new alternative to the NLRB should have as its major features the following:

- a. Decisions are court enforceable
- b. Universal stipulation(achieved through owners)
- c. Decisions set national precedent
- d. Apply weighted decision criteria
- e. Bi-level appeal procedure
- f. Expeditious procedure(72 hours)
- g. Penalties for job action

The decision criteria should conform to NCEC principle No. 2 as previously referenced. The combining of the criteria used by the NLRB and IJDB as discussed in Chapter Five is most appropriate. To make this work, revisions to the Green Book in order to adequately reflect the current state-of-the-art in construction is necessary. Once this is done, negotiations should be able to determine a fair weight to be given to each criterion.

Finally, in structuring the new IJDB, careful review of current functional plans such as the one in New York City should be undertaken. Adoption of workable concepts from local level plans may prove helpful in restructuring the national system.

#### Future Research Needs

As noted in Chapter One, there is little published information concerning the issue of jurisdictional disputes. The following are areas that this researcher has identified as useful in assisting the construction industry in its dealings of jurisdictional issues:

1. Determine the influence of jurisdictional disputes on the growth of the open shop movement
2. Determine the impact on the owner when jurisdictional disputes occur on a project.

3. Determine the union memberships' concerns over changing work practices in the face of new materials, equipment and technology.
4. Determine the extent that jurisdictional disputes have aided the open shop movement.
5. Determine the role of the owner with respect to jurisdictional disputes. How can he maintain a non-agency relationship with the contractor.

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## APPENDIX A

## EXPLANATION OF NLRB DECISION CRITERIA

This information is extracted with permission from "Construction Jurisdictional Disputes: A Critical Evaluation of Legal Remedies" (47).

IV. NLRB DECISION-MAKING UNDER SECTION 10(k)

Following the Supreme Court's CBS decision, which directed the Board to make an affirmative award of the disputed work in a 10(k) hearing, the Board, in the 1962 Jones Construction case, announced its intention to make such awards after consideration of "all relevant factors," "on the basis of common sense and experience" and on the basis of the particular facts of each case. The Board now makes many 10(k) awards each year, and has adhered to the case-by-case method described in the Jones decision. Typically, the Board outlines the facts briefly, considers each of the commonly-applied factors which are relevant to the particular situation, and decides whether the factors favor either employee group. The Board then reaches its "conclusion" by balancing the relevant factors, determines which union or employee group is entitled to perform the work, rules that the other employee group is not entitled by means prohibited by the

statute to force or require the employer to make a contrary assignment, and orders the losing group to notify the NLRB regional office whether it intends to respect the Board's ruling.

The Board customarily evaluates the following factors in making 10(k) awards:

Skills and work involved - Several recurring situations serve to illustrate the Board's application of the skill and work factor. First, almost by definition, the employee group currently performing the disputed work has the necessary skill to do so. The Board consistently favors the claim of that group over the claim of a union which asserts that the greater skill of its members supports a contrary assignment. For example, in a 1979 aerospace dispute involving the IBEW, 19/ the Board upheld the assignment of electrical thermocouple installation to members of the Machinists union, in part because the work was unskilled and did not require the knowledge of electricity or other "superior skills" possessed by IBEW. Second, where a more skilled group of employees has the employer's assignment, the Board consistently relies in part upon that superior skill in sustaining the assignment, particularly where the competing claimant's members do not or may not have the ability to perform the work without training. For example, in a 1972 utility construction case involving heavy rigging, 20/ underwater welding, and marine equipment handling, it was uncontradicted that members of the Laborers union did not have the ability to perform the work. Consequently, the Board

had little difficulty upholding the employer's assignment of the work to pile drivers represented by the Carpenters. Similarly, in a 1971 case involving installation of acid proof flooring in a brewery under construction, 21/ the Board upheld the assignment of the work to tile setters rather than to bricklayers because bricklayers did not have the ability to perform all of the necessary tasks without some training. Third, if both claiming employee groups possess the skill to do the work, the Board simply labels the skill factor "inconclusive" and awards the work on the basis of other factors. Finally, the Board frequently focuses on the nature of the work in situations where an employer introduces new equipment and methods for which employees must be trained in any event. Employees who would be displaced by new technology are viewed as having a strong claim to the new work tasks unless other factors conclusively negate their entitlement. Considerations of that sort are most commonly applied in printing industry and specialized manufacturing disputes. To date, they have not figured significantly in the construction industry.

NLRB certifications - NLRB certifications are not a significant factor in construction industry jurisdictional dispute cases because few construction industry unions are certified, i.e., recognized officially by the NLRB as the winner of a valid Board-conducted election. In non-construction jurisdictional disputes, the weight accorded a certification depends upon how clearly the certification covers the disputed work. In

theory, if one union possesses a certification which clearly covers the work, it is privileged to use otherwise unlawful jurisdictional pressure to enforce it, for Section 8(b)(4)(D) provides that jurisdictional pressure is unlawful unless the employer is failing to conform to a Board certification. One district court has relied upon that language to deny Section 10(1) injunctive relief 22/ in a maritime dispute. Moreover, in a case where a manufacturing union's certification covered the work in dispute rather clearly, the NLRB, on the basis of a charge against that union, conducted a 10(k) hearing, though it awarded the work to the certified union and relied heavily on the certification. 23/ Likewise, in an unusual construction industry case involving an IBEW certification as representative of all production and maintenance employees of the members of a NECA chapter in electrical utility construction in a four state area, 24/ the Board gave considerable weight to the certification in awarding reinforcing bar installation work to IBEW rather than an Ironworkers local. In more typical cases involving certifications which are not clear, the Board attempts to determine whether its language supports the claim of either employee group and, if it does, the Board weighs that factor without according it conclusive weight. 25/

Company and industry practice - The Board customarily considers the past work assignment practices of the particular employer, the assignment practices of other employers in the

general area, and the practices of industry generally if such information is available. The Board's treatment of the practice factor is inconsistent. In some cases the Board gives great weight to a well-established employer practice, concluding that the factor of practice favors the employee group selected by the contractor even if area practice is to the contrary. For example, in a 1977 decision involving installation of hotel kitchen equipment, 26/ the Board found that a manufacturer-installer's past practice of assigning the work of weld seam polishing on "outside" jobs to its own employees represented by the Metal Polishers outweighed the predominant area practice in the locality of assignment to Sheet Metal Workers. In other cases, however, the Board declares that it will not disturb an established area practice absent "some compelling reason," and may overrule an employer assignment on that basis. Thus, in a 1973 ruling involving the dismantling of forms, 27/ the employer assigned the work to Laborers, and supported the assignment with evidence of its past practice in other areas and more advantageous wage rates. The Board awarded the work to Carpenters on the basis of established area practice. Where there is no uniform employer past practice, the Board accords significant weight to area practice, and may also set aside the employer's assignment predominantly on that basis. For example, in a 1972 decision awarding the work of operating a boiler which provided heat for a construction site to an Operating Engineer local, the Board

overruled the employer's assignment to members of another union 28/ possessing equal skill because area practice overwhelmingly favored the Engineers and the employer had no past practice. It is unusual for the Board to accord conclusive weight to employer and area practice; in more typical cases, though the Board considers the practice factor, it normally coincides with other more important factors, such as efficiency and employer assignment.

Collective bargaining agreements; interunion agreements - A recognition clause or other language in a collective bargaining agreement which specifies that a particular union is to represent the employees performing disputed work is ordinarily respected by the Board. That is not to say that the Board does not review the other relevant factors in a 10(k) case involving such an agreement, but only that the union holding such contract rights almost always prevails. A clear example of the Board's policy in this respect is the 1978 Mukluk Freight Lines case, 29/ which dealt with the work of lubricating equipment used in rigging, dismantling, and transporting oilfield drilling rigs and operated by Teamsters members. The employer, Mukluk, operated a repair shop where the disputed lubrication work was performed, Mukluk's past practice had been to use an Operating Engineer for the work. The employer favored the continuation of that assignment, and considerations of economy and efficiency strongly supported the Operating Engineers. Nevertheless, the Board found that contract language reserving the work of

lubricating equipment operated by Teamsters to Teamsters required an award contrary to the employer's preference. The Board has given significant weight to comparable contract language in many other cases. It refuses to give it weight only if the agreement was signed as a result of unlawful coercion by the union, as in the 1974 Bricklayers Local 1 30/ case where the charged union refused to proceed with the laying of brick unless the employer also assigned it disputed insulation work, and later prevailed upon the employer to sign an agreement purportedly formalizing the disputed assignment.

Frequently, two unions having collective bargaining agreements with an employer will claim entitlement to work on the basis of contract language. In such cases, the Board attempts to determine which contract language is more specific, and also looks to past practice under the agreements. For example, in the 1978 Codell 31/ case, the contending claimants were a United Mine Workers construction local on the one hand and three construction craft unions on the other. The work in dispute was the construction of a spur connecting a mine site to an existing rail line. The UMW relied upon an agreement between it and Codell which covered "all work related to the development, expansion, or alteration of coal mines..." The Board found that the above clause was broad enough to encompass the disputed work, but that it did not specifically cover it. The craft unions relied upon Codell's oral agreement to apply their area-wide contracts on the

site; the Board found that those contracts did specifically cover the disputed work. Looking to past practice as an aid to construing the UMW agreement, the Board also noted that the UMW had apparently acquiesced in Codell's practice of employing craft unions to perform comparable construction work if Codell's construction contract was with a railroad rather than a mine. Consequently, the Board found that the collective bargaining agreements favored the craft unions.

With respect to interunion jurisdictional agreements, the Board considers them relevant in awarding work but rarely gives them significant weight. In part, this policy undoubtedly reflects the Board's long standing unwillingness to recognize any dispute resolution mechanism to which "all parties," including the employer, have not consented. Thus, for example, in the 1976 Brockway Glass 32/ case, an agreement between the Laborers and Glass Bottle Blowers International Unions clearly provided that the work of tending brick masons on new construction or rebuilding of tanks and furnaces belonged to the Laborers. Though the Board found that the agreement favored the Laborers claim, it upheld the employer's contrary assignment, supported by most other relevant factors, without difficulty. Likewise, in the 1975 Warner Masonry 33/ decision, the Bricklayers and Plasterers International had clearly agreed that plastering work within the State of Arizona belonged to the Plasterers. Because the Bricklayers, who had the employer's assignment, refused to



recognize the agreement as binding, the Board declined to rely upon it. An additional factor that makes it difficult for the Board to rely upon interunion agreements is that they are often so ambiguous that their intended meaning cannot be ascertained. Thus, in the 1974 Concrete Casting 34/ case, the Board was unable to accord weight to a Carpenters-Ironworkers agreement because the meaning of the terms "rigid frame building" and "nailable stran-steel members" remained unclear even after considerable testimony.

Arbitration and IJDB awards - As noted above, the Board does not recognize as binding any arbitration or IJDB award unless each competing employee group, as well as the employer, has consented to be bound. The Board also does not generally give significant weight to non-binding awards of this type. That result is to be expected, because the IJDB utilizes interunion agreements, its own past decisions, trade practice, and area practice as primary criteria for decision making, factors which are rarely considered dispositive by the NLRB. The Board frequently has issued 10(k) decisions directly contrary to IJDB decisions in the same dispute. Thus, in the 1975 Warner Masonry case, 35/ an IJDB award stated that the Plasterers union was entitled to perform the work in question. The Board paid little heed to the award because it did not explicate what factors were relied on and what factors favored each union. The Board also gave little weight to a National Joint Board award in the 1971

Morris & Sons case 36/ because the tribunal relied only on "alleged trade practice" and failed to explicate its decision in sufficient detail, and gave no deference to an IJDB award in the 1977 Rocky Mountain Prestress case 37/ because the employer did not participate and was not bound, and because the award did not discuss the "crucial issue" of whether the factors supporting one union's claim outweighed those supporting the other's. Likewise, arbitration awards generally are not regarded by the Board as persuasive because usually only one union participated in the proceeding. Thus, in the 1974 Telegraph Publishing case, 38/ one union secured an arbitration award holding that a newly-introduced printing process fell within its contractual jurisdiction. The Board majority awarded the work to the other claimant, rejecting the dissent's argument that the arbitration award should prevail over the employer's "subjective preference" and should be viewed as an authoritative interpretation of the contract.

Efficiency - Efficiency is almost always the critical determinant in NLRB 10(k) awards. In appraising this factor, the Board, in effect, puts itself into the shoes of the business and attempts to determine which work assignment is more logical, economical, and businesslike. It is impossible to illustrate fully the Board's application of the efficiency factor because each work assignment dispute decided primarily on that basis arises out of a unique factual situation. There are, however, certain recurring patterns in the Board's determinations.

The Board's efficiency evaluations strongly favor the work assignment which will not compel the employer to hire additional employees. Among the many examples is the 1971 H. M. Robertson decision, 39/ where Laborers performed all of the work incident to installing pipe, including digging and backfilling, and a UA local attempted to acquire only the actual installation work. The Board found the Laborers entitled to the work because the employer was presently accomplishing the work with fewer employees than would be needed if the UA prevailed. Similarly, in the 1978 Cullen cases, 40/ an Ironworkers local claimed the work of welding metal plates which were to form the edge of poured concrete floors and which replaced traditional wooden forms. Carpenters had been assigned all of the forming work, including the welding. The Board found that the efficiency factor favored the Carpenters because the disputed welding work was sporadic and minimal, and that an award to the Ironworkers would have compelled the employer to hire additional employees and make special arrangements with the union hall whenever their services were needed. And in the 1977 Elevator Industries Association case, 41/ the Board observed that the work assignment urged by the charged union would require the hiring of "two work complements" and found a "substantial" economy and efficiency advantage in the employer's chosen work assignment.

The Board often points to the avoidance of downtime and employee versatility as important factors in its efficiency

determinations in construction industry cases. Thus, in the 1978 J. E. D. case, 42/ the employer used Laborers for all of its masonry work, and an Operating Engineers local claimed the work of operating a forklift on the site. Because the evidence showed that the forklift was in use only six hours a day and that Laborers operating the forklift were trained to perform other tasks such as mixing and scaffold building during the remainder of the day, the Board found that the efficiency factor favored them. Likewise, in the 1978 Cruz case, 43/ employees represented by the Steelworkers who operated heavy equipment at a sewer line construction site were able to perform ironwork and carpentry when heavy equipment was not in use, while Operating Engineers members were not. The Board found that the employer's assignment would result in "faster and more economical completion" of the project.

In making efficiency determinations, the Board also considers employee wage rates, whether additional supervision would be necessary if a particular assignment were made, whether an assignment might create safety risks, and any other economic factors which are presented to it. Regardless of the evidence which the Board considers and relies on in any case, however, most construction industry jurisdictional disputes conform to a pattern: the attempt to force an employer to hire unnecessary employees possessing unnecessary, costly skills. Because hiring such employees is generally not consistent with sound business

practice, the Board almost never rules that they are entitled to perform disputed work.

Employer Assignment - Much of the criticism of the NLRB's 10(k) decisional process centers on the fact that the Board generally rules in favor of the union assigned the work in dispute by the employer. The Board explains this tendency by contending that employers take into account in making work assignments the same factors which it evaluates in 10(k) decisions, and denies that it has made employer preference the controlling consideration. There is undoubtedly much truth in the Board's explanation, because employers generally prefer to make work assignments on the basis of efficiency and the provisions of certifications and collective bargaining agreements, the factors that weigh most heavily in the NLRB's 10(k) determinations. Moreover, where other factors persuasively support a different assignment, the Board does overrule the employer's assignment. In cases discussed earlier in this report, the Board overruled the employer's assignment in Mukluk Freight Lines because of a union's contractual entitlement to the work, and overruled two other employer assignments on the basis of contrary area practice. There are other 10(k) awards in which the employer's assignment of work was not given effect. Absent unusual circumstances, however, the employer's preference is honored by the Board if it represents an honest exercise of business judgment.

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- 43/ Operating Engineers Local 825 (Cruz Contractors, Inc.), 239  
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## APPENDIX B

## PERSONNEL INTERVIEWED

Addison, J.K. Manager, Labor Relations, Safety & Services, E.I. DuPont De Mours & Company, L-1234, Wilmington, Del. 19898, 302-366-4866.

Beckley, Thomas A. Lawyer, Pennsylvania Subcontractors Association, 240 North Third Street, Harrisburg, Pa. 17108, 717-233-7691.

Booker, Carl E. Director of Jurisdiction, Laborers' International Union, 905 16th Street, N.W., Washington, D.C. 20006, 202-737-8320.

Canavan, William A. Chairman, Board of Governors, Building Trades Employers' Association, 711 Third Avenue, New York, N.Y. 10017, 212-697-2860.

Crump, James K. Chief International Representative, Sheet Metal Workers' International Association, 1750 New York Ave., N.W., Washington, D.C. 20006, 202-783-5880.

Davis, James E. Assistant to the General President for Jurisdictional Disputes, United Brotherhood of Carpenters and Joiners of America, 101 Constitution Ave., N.W., Washington, D.C. 20001, 202-546-6206.

Doherty, Henry T., Jr. Business Manager, Harrisburg and Central Pennsylvania Building and Construction Trades Council, 325 Front Street, New Cumberland, Pa. 17070, 717-774-3800.

Gemmill, Dale K. Executive Director, Keystone Building Contractors Association, Pennsylvania Builders Chapter of the AGC, 2415 North Front Street, Harrisburg, Pa. 17110, 717-238-8235.

Helfrich, Thomas G. Supervisor of Contractor Labor Relations, GPU Nuclear Corporation, P.O. Box 480, Middletown, Pa. 17057, 717-948-8110.



Hershey, Harry W. Representative, H.B. Alexander and Son, Inc., 315 Vaughn Street, Harrisburg, Pa. 17105, 717-234-7041.

Vicastro, Joe Representative, Laborers' International Union, Regional Office, 240 North Third Street, Harrisburg, Pa. 17110, 717-236-5055.

Markey, Richard. Representative, Associated Builders & Contractors, Inc., 444 N. Capital Street, Suite 409, Washington, D.C. 20006, 202-637-3800

Moore, Arthur. President and Business Manager Sheet Metal Workers' International Association, Local Union 28 of New York City, 1790 Broadway, New York, N.Y. 10019, 212-541-6200.

Sheil, Dennis R. Secretary-Treasurer, N.Y. District Council of Carpenters, 204-8 East 23rd Street, New York, N.Y. 10010, 212-686-3278.

Shenberger, Albert H. Business Manager, Laborers' District Council of Eastern Pennsylvania, 2163 Berryhill Street, Harrisburg, Pa. 17104, 717-564-2707.

Simms, Gary D. Assistant Director, Collective Bargaining Services, Associated General Contractors of America, 1957 E Street, N.W., Washington, D.C. 20006, 202-393-2040.

Weber, Enid W. Associate Executive Secretary, National Labor Relations Board, 1717 Pennsylvania Ave., N.W., Washington, D.C. 20570, 202-254-9430.

Weberski, John A. Director of Jurisdiction, International Union of Operating Engineers, 1125 Seventeenth St., N.W., Washington, D.C. 20036, 202-429-9100.

Witcraft, Dale. Chairman, Impartial Jurisdictional Disputes Board, 815 16th Street, N.W., Washington, D.C. 20036, 202-783-6817.

## APPENDIX C

## NYC PLAN FOR THE SETTLEMENT OF JURISDICTIONAL DISPUTES

This appendix contains the preamble for the NEW YORK PLAN FOR THE SETTLEMENT OF JURISDICTIONAL DISPUTES between The Building and Construction Trades Council of Greater New York and The Building Trades Employers' Association of the City of New York.

## PREAMBLE

Realizing the vital economic importance of maintaining harmony in the building and construction industry in the City of New York, and to preserve the machinery which has been in existence since 1903 for the resolution of jurisdictional disputes among the various trade unions affiliated with the Building and Construction Trades Council of Greater New York, we, the authorized representatives of the Building and Construction Trades Council of Greater New York and of the Building Trades Employers' Association of the City of New York (hereinafter referred to as "BTEA") hereby agree that the general procedure outlined hereinbelow shall govern all such trades involved in jurisdictional disputes.

1. The contractor who has the responsibility for the performance and installation shall make a specific

assignment of the work which is included in his contract. Assignments shall be based on Decisions of Record contained in the Handbook of the BTEA or if there be none, by National Decisions or Agreements of Record, if any. When a contractor has made an assignment of work he shall continue the assignment without alteration unless a change is agreed to between the contending unions or because of a decision of record of the Executive Committee of the BTEA.

2. Whenever a dispute arises over an assignment of work on a job site, the business agent of the trade objecting to the assignment shall request a meeting on the job site with the business agent of the trade in possession of the work assignment. Request for such meeting should be made through the Building and Construction Trades Council office. Said meeting shall be held within three (3) working days excluding the day of said request and the business agents shall use their best efforts to resolve the dispute. Business Agents should abide by decisions if specified in Handbook of the BTEA or when there is none, by the National Decision or Agreement of Record, if any. Work in dispute must proceed in accordance with original assignment by the contractor.

3. In the event the representatives of the trades involved in the dispute fail to resolve the question, the trade contesting the assignment may submit the dispute to

the Building and Construction Trades Council of Greater New York for mediation. Mediation shall be conducted where possible within two (2) weeks from date of request by the President of the Council or his designee, and the Chairman of the Board of Govenors of the BTEA or his designee, with the respective representatives of the trades to the dispute. Employers are not allowed to participate in the mediation hearing. The Secretary of the BTEA shall act as the Secretary of the mediation process.

4. If the dispute is not resolved through mediation, the trade contesting the assignment may submit the matter for arbitration to the Executive Committee of the BTEA by request in writing to the Building and Construction Trades Council of Greater New York setting forth a description of the work involved in the dispute and requesting a date for the hearing.

5. The Executive Committee of the BTEA recognizes all bonafide decisions and agreements between two or more International Unions, provided the International Unions agree that the disputed work is covered by the agreement. If either International Union disagrees then a request for arbitration will be entertained. The arbitration hearing shall be held where possible within two (2) weeks from the date of request before the Executive Committee of the BTEA acting as a Board of Arbitration, and the notice of such

hearing shall include a list of the members of the Executive Committee and their respective affiliations. The parties to the dispute shall be permitted to appear and produce evidence in support of their position, including the calling of witnesses. All hearings are to be held in the offices of the BTEA.

A majority of the Executive Committee members shall constitute a quorum. A member of the Executive Committee of the BTEA shall not sit on any case that may come before the Board wherein such member may have an interest by virtue of the fact that he is an officer or representative of the employer whose job is involved in the dispute.

In the event the work is determined by the Building and Construction Trades Council to be heavy construction and the dispute is submitted to the Building Trades Employers' Association under the provisions of paragraph 4 above, then the Chairman of the Board of Governors of the Building Trades Employers' Association shall consult with the President of the General Contractors Association and request from him the names of four contractors affiliated with the GCA to be appointed by him to serve on the jurisdictional panel and participate in the decision. No member of the General Contractors Association shall sit on any case that may come before the Board when such member may have an interest by virtue of the fact that he is an officer or representative

of the employer whose job is involved in the dispute.

Minutes of the hearing shall be stenographically recorded and a copy of said minutes shall be sent to each party involved in the dispute. After the hearings have been ruled closed by the Chairman of the Executive Committee, who shall preside as Chairman of the Board of Arbitration, a decision will be rendered on the evidence submitted by only those members of the Committee who heard the evidence and an award of the work shall be made where possible within one (1) week, and shall become effective immediately. The vote on the award of the work shall be by secret ballot and the Chairman shall vote only in the event of a tie vote of the Executive Committee.

6. The award shall be added to previous awards made and printed and published in the Handbook of the BTEA, commonly referred to as "the Green Book", and shall thereafter govern the awarding of the work of the kind in question on all future jobs.

7. An appeal from the decision of the Executive Committee of the BTEA may be filed directly with the Impartial Jurisdictional Disputes Board for the Construction Industry no later than seven (7) calendar days after the date of the letter transmitting the decision to the affected parties, in accordance with the rules and procedures of the said Board.

8. If an appeal is not taken under the provisions of paragraph 7 above, nevertheless, a request for a rehearing from the decision of the Executive Committee of the BTEA may be made to the Chairman of the Board of Governors of the BTEA based on the submission of new evidence in writing within two (2) weeks after receipt of decision. The Executive Committee will consider the new evidence and determine whether or not the request for a rehearing is warranted.

9. Pending the resolution of any jurisdictional dispute under the terms of this agreement, there shall be no work stoppage by any trade involved in the dispute. If a trade orders a work stoppage because of a dispute the Building and Construction Trades Council shall immediately order the union involved to cease and desist such action.

10. Ex parte hearings may be held after proper notification is given by registered mail to the contending unions.

11. No lawyer will be permitted to present the case for any of the parties to the dispute nor will be allowed to act as an arbitrator, counsel or advisor at any proceeding held under this Plan.

12. The decisions of the Executive Committee of the Building Trades Employers' Association of the City of New York shall be enforced by the Building and Construction Trades Council of Greater New York, as outlined by the

Constitution and By-laws of the Building and Construction Trades Council and Building and Construction Trades Department.

13. This agreement may be subject to change by the mutual consent of the parties hereto. Any changes or amendments agreed upon shall be reduced in writing and signed by the parties hereto.



## APPENDIX D

## QUESTIONNAIRES AND RESULTS

Sample Cover Letter

## THE PENNSYLVANIA STATE UNIVERSITY

212 SACKETT BUILDING  
UNIVERSITY PARK, PENNSYLVANIA 16802

College of Engineering  
Department of Civil Engineering

Area Code 814  
865-8391

24 August 1992

Sir:

I am a U.S. Army Corps of Engineers Captain working towards my Master of Science in Civil Engineering-Construction Management. My thesis topic is "An Evaluation of Voluntary Resolution Procedures for Jurisdictional Disputes in the Construction Industry."

The heart of my research effort is the collection and evaluation of both union and contractor experiences and perceptions when faced with a jurisdictional dispute on a construction site. My study encompasses those disputes that are ultimately decided via a voluntarily agreed upon procedure such as the Impartial Jurisdictional Disputes Board or are taken to the National Labor Relations Board.

My objective is to evaluate the current voluntary system (under revision) versus the statutory National Labor Relations Board procedures and determine if a mutual basis of understanding exists between management and labor to continue with some practicable alternative to the NLRB.

The inclosed questionnaire is designed to supplement my personal interviews with various contractor (ie Dale Gemmill, Keystone Builders Association; Gary Simms, AGC) and union (ie James Davis, United Brotherhood of Carpenters and Joiners, Dale Witcraft, Impartial Jurisdictional Disputes Board) officials, thereby increasing the statistical validity of my data base. Your cooperation is very much needed and appreciated.

Please return your response in the inclosed envelope within two weeks after receiving this letter. A copy of my thesis will be available at the Civil Engineering Department of Penn State.

Thank you very much.

- 2 Incl.  
1. Questionnaire  
2. SSA envelope

Sincerely,

*Dennis W. Heuer*  
Dennis W. Heuer

## Tabulated Union Response

### QUESTIONNAIRE CONCERNING JURISDICTIONAL DISPUTE RESOLUTION PROCEDURES

Union  
Level: National; Regional; Local

24 August 1982

ORGANIZATION (optional) \_\_\_\_\_  
ADDRESS (optional) \_\_\_\_\_

Please place a mark in the space next to the answer or answers you select for each question. If you do not find a suitable response listed, please write in your own. Additional comments and explanations of answers are encouraged and will be appreciated.

1. What common issues cause jurisdictional disputes?

- ☐ 2 new materials
- ☐ 2 restrictive labor practices
- ☐ 2 union preserving traditional work rights from original charter
- ☐ 2 union expanding work rights
- ☐ 2 contractor seeking efficiency
- ☐ 2 contractor prefers not to hire traditional workers for the task
- ☐ 1 no agreement of record
- ☐ 1 contractor error in interpretation of job rules
- ☐ 1 union reluctance to reach new agreements of record
- ☐ 3 subcontractor performing varied tasks with the single craft he employs
- ☐ 3 intentional contractor misassignment
- ☐ 1 Business Agent trying to look good in eyes of membership
- ☐ 1 current slump in economy
- ☐ 1 conflict of union (political organization) vs contractor (business org)
- ☐ 1 reluctance of union to adopt new techniques
- ☐ 3 two trade organizations claim the same work in collective bargaining agreements
- ☐ 1 reluctance of unions to change internal structure
- ☐ other \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Note: Although the current Impartial Jurisdictional Disputes Board (IJDB) is suspended and being renegotiated, it is used herein as a basis of comparison as an alternate dispute resolution procedure to the National Labor Relations Board (NLRB).

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2. Place a X next to those qualities you view as significant advantages;

of the IJDB over the NLRB

- 2 renders fastest decisions of procedures available
- 4 decisions made by people familiar with construction
- 3 equity of consideration of all parties' viewpoints
- 2 international union expeditiously orders union back to work
- 3 encourages unions to reach and sign new agreements
- 2 keeps stability in industry
- 4 prevents deluge of cases to NLRB
- 3 maintains consistency of decisions on similar cases
- 2 observes originally chartered union work rights
- does not issue decisions based on case history (precedents)
- levies fines to enforce decisions
- 3 bases decisions on agreements & decisions of record (Green 9k)
- other \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

of the NLRB over the IJDB

- more thorough in evaluating the total work picture
- 1 follows legal rules and procedures
- 1 decisions are court enforceable
- considers economy & efficiency in rendering decisions
- 1 considers contractor preference in rendering decisions
- 2 can enjoin job action and force resumption of disputed work
- greater than 90% of rulings uphold contractor assignment
- considers rulings made on past cases (precedential authority)
- other \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

3. Place a X next to those qualities you view as significant disadvantages;

of the IJDB over the NLRB

- 2 no precedential authority
- 5 contractors are not universally bound to this procedure
- 2 poor enforcement procedure
- 4 Green Book needs updating & review (is every 5 years)
- cumbersome in collecting, presenting & disseminating information on disputes
- 1 no procedure to consider technological advances
- appeals procedure does not have "outsiders" relook case
- 1 does not handle repetitive disputes
- 4 decisions not enforced

of the NLRB over the IJDB

- 3 does not place sufficient emphasis on historical claims to work
- 3 decisions take too long (greater than 2 months)
- 2 too expensive (must bear cost of defense)
- slow to get workers back to work
- 1 has an overall heavy caseload
- 5 personnel are not familiar with construction operations
- 2 government interference in private industry
- 1 follows complete legal procedures on each case, does not issue summary rulings

Page 3

## Question 3 continued

of the IJDB over the NLRB

- \_\_\_\_ receives more labor input than management in hearing cases
- 3 IJDB chairman cannot take action against unions that intentionally claim another unions work
- \_\_\_\_ does not address owner preferences
- 2 cannot apply previous decisions to another job
- \_\_\_\_ other \_\_\_\_\_
- \_\_\_\_
- \_\_\_\_

of the NLRB over the IJDB

- 4 greater than 90% of rulings uphold contractor work assignment
- \_\_\_\_ does not address repetitive disputes
- 4 no weight given to trade practice
- 5 blurs craft jurisdictional lines
- \_\_\_\_ other \_\_\_\_\_
- \_\_\_\_
- \_\_\_\_

4. Rank in order of your preference (1 to 9) the following criteria that any resolution procedure should consider when arriving at a decision:

- 3 Bargaining agreements
- 4 Skills of workmen and task involved
- 5 Industry custom and practice
- 3 Employer preference and past practice
- 1 Decisions of record
- 1 Agreements of record
- 3 Efficiency and economy
- 4 Prevailing local practices
- 1 Established trade practice
- \_\_\_\_ Other \_\_\_\_\_

Ranking tabulated is follows: T=Top Third-Ranking 1-3  
M=Middle Third-Ranking 4-6 and B=Bottom Third-Ranking 7-9

- b. Should all of the above criteria be incorporated in reaching a decision?

3 Yes 2 No Comment: \_\_\_\_\_

\_\_\_\_\_

- c. Should a decision be reached through selective application of some of the above criteria?

3 Yes 2 No Comment: \_\_\_\_\_

\_\_\_\_\_

5. Can any alternative to the NLRB be successful as a dispute resolution system without all unions and contractors being bound to this procedure?

1 Yes 4 No Comment: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Page 4

6. It has been suggested that craft union consolidation, either permanently or by project, is a valid approach to reduce jurisdictional disputes on job sites. Do you agree?

3 Yes 2 No Comment: \_\_\_\_\_

- 7 Do you favor the NLRB as the sole avenue to resolve jurisdictional disputes?

0 Yes 5 No Comment: \_\_\_\_\_

- b. Do you favor an alternative to the NLRB?

5 Yes 0 No Comment: \_\_\_\_\_

- c. Should an alternative procedure be organized under procedures similar to the American Arbitration Association?

0 yes 4 No Comment: \_\_\_\_\_

8. The New York City Plan for the Resolution of Jurisdictional Disputes has been working as a local alternative to the IJDB and the NLRB since the early 1900's. It involves a 3 step process:

- 1-Initial settlement attempts on job site
- 2-Mediation settlement, binding on the job in question only
- 3-Arbitration settlement, which sets a precedent for the entire NYC area and can be enforced in the courts; only management representatives are permitted on the arbitration panel

Does this form of a resolution procedure appear practical for use on a national level?

3 Yes 1 No Please explain your answer: \_\_\_\_\_

This concludes the questionnaire. I sincerely appreciate your assistance and time spent in answering these questions.

## Tabulated Contractor Response

### QUESTIONNAIRE CONCERNING JURISDICTIONAL DISPUTE RESOLUTION PROCEDURES

Contractor  
Level: National;Regional;Local

24 August 1982

ORGANIZATION (optional) \_\_\_\_\_  
ADDRESS (optional) \_\_\_\_\_

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- M Industry custom and practice
- T Employer preference and past practice
- M Decisions of record
- M Agreements of record
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- T Prevailing local practices
- 3 Established trade practice
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5 Yes      2 No      Comment: \_\_\_\_\_

7. Do you favor the NLRB as the sole avenue to resolve jurisdictional disputes?

2 Yes      5 No      Comment: \_\_\_\_\_

- b. Do you favor an alternative to the NLRB?

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Does this form of a resolution procedure appear practical for use on a national level?

4 Yes      1 No      Please explain your answer: \_\_\_\_\_

This concludes the questionnaire. I sincerely appreciate your assistance and time spent in answering these questions.

### Union Comments

#### QUESTION 1

Decisions by NLRB only substantiate contractor assignment.

#### QUESTION 4

Efficiency and economy important--but most often taken out of context, depending on contractor saying it. Badly misused.

4b. Not where there is a Decision of Record or an Agreement.

#### QUESTION 5

Not when some unions and contractors want best of two worlds.

Local Board with power.

#### QUESTION 6

All similar crafts, i.e. Mechanical.

#### QUESTION 7

Too much delay.

#### QUESTION 8

Procedure will settle dispute quickly with management included.

The Arbitration panel should be only those people that are active and knowledgeable of the Construction Industry--not lawyers or accountants.

Too long and legislative.

### Contractor Comments

#### QUESTION 1

Single employer contractors (subcontractors) cause the majority of jurisdictional disputes.

## QUESTION 2

The NLRB should not render decisions in jurisdictional disputes, they should defer to the voluntary plan in the industry.

## QUESTION 3

Green Book needs to have obsolete decisions and agreements culled out and should be used as a "guide" only.

## QUESTION 4

Jurisdiction should not be a subject of collective bargaining and an agreement should not be used as a "club" in forcing obvious misassignment.

4b. Considered but on a weighted basis. Efficiency and economy should carry more significance than bargaining agreement.

Sometimes they may contradict.

4c. The rules of the IJDB place decisions and agreements of record first, which is not always the most efficient or economical.

There must be a starting point.

## QUESTION 5

Stipulation is the basic requirement for success and it is the cause of present suspension of the IJDB.

To have a successful resolution system, all parties must be committed to the system and be willing to abide by the decisions handed down.

## QUESTION 6

Unions are famous for not getting along with each other when it comes to jurisdictional assignments.

It could reduce the overt dispute--but craft consciousness among the merged tradesmen would still cause some problems.

The current fifteen unions could be reduced to a maximum of five. At the present rate, they are losing members. This might happen naturally.

Mechanical trade unions, i.e. pipefitters, plumbers, sheet metal workers and electrical workers should be one union.

## QUESTION 7

Industry voluntary procedure with enforcement power is

better.

The NLRB has only hurt the situation.

It is too cumbersome and time consuming to be effective on the large scale heavy industrial projects.

7b. Leave the government out completely.

7c. That's a possibility, but selection of the Arbitrators may be too cumbersome.

The present plan with a few modifications will work.

This would be an acceptable arrangement if it could be operated in an expedient fashion.

#### QUESTION 8

On its face, this seems acceptable but I've got to believe that in actual fact the NYC plan is subject to too much union political pressure.

This plan has succeeded because the entire industry in the city subscribes to it--they are all stipulated.

It depends upon getting all parties to agree to the procedure. I doubt that this can be accomplished on a national level--or it would have by now. It would be nice though.

Has possibilities and may expedite a decision.

## APPENDIX E

## INDUSTRY REACTION TO FINDINGS

Sample Cover Letter

## THE PENNSYLVANIA STATE UNIVERSITY

212 SACKETT BUILDING  
UNIVERSITY PARK, PENNSYLVANIA 16802

College of Engineering  
Department of Civil Engineering

Area Code 814  
965-8391

9 November 1982

Sir:

During our interview(conversation) this past summer on jurisdictional disputes, I told you of my plan to seek you comments when my research was complete. My findings and recommendations are inclosed for your comment. I am not requesting formal, coordinated organizational responses, only your initial impressions and comments.

I have completed my draft thesis with as little bias for union or management positions as possible. My current position as a student has assisted in maintaining this nonaligned perspective.

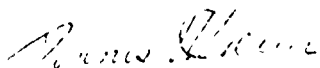
In order to properly document our interview, I am including an appendix in my thesis with the professional data on each person interviewed. Your cooperation in completing the inclosed form will assist me in this effort.

Please complete the forms and return them to me in the inclosed envelope within 10 days. A copy of my thesis entitled, "An Evaluation of Alternative Resolution Procedures for Jurisdictional Disputes in the Construction Industry" will be available at the Civil Engineering Department or from the Graduate School in March, 1983.

Thank you for your cooperation and insight on jurisdictional dispute matters.

3 Incl  
as

Sincerely,



Dennis J. Hauer

## Sample Industry Questionnaire

### AN EVALUATION OF ALTERNATIVE RESOLUTION PROCEDURES FOR JURISDICTIONAL DISPUTES IN THE CONSTRUCTION INDUSTRY

Please address your comments to the following issues. Use additional space as necessary.

1. Finding: A common basis of understanding exists between management and labor on the desire to formulate and implement an alternative settlement plan to the NLRA.
  - a. IJDS with some modifications will work
  - b. Stumbling block is reluctance to change: Neither side wants to appear weak by offering concessions or compromises

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

2. Relevant Issues
  - a. Both sides want a procedure that is:
    - 1) Fair
    - 2) Equitable
    - 3) Expedient
    - 4) Consistent
    - 5) Enforceable
    - 6) Administered by construction familiar individuals
    - 7) Free of governmental influence

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_

- b. Issues that require resolution with my recommendations concerning them:
  - 1) Enforcement authority--Courts
  - 2) Stipulation--Universal
  - 3) Scope of application--Nationwide
  - 4) Precedential authority--Similar to legal system
  - 5) Decision criteria--Weighted application of:
    - a. Bargaining agreements
    - b. Skills of workmen and tasks involved
    - c. Industry custom and practice
    - d. Employer preference and past practice
    - e. Decisions of record } After Green Book is
    - f. Agreements of record } reviewed & revised
    - g. Efficiency and economy
    - h. Prevailing local practice
    - i. Established trade practice

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Page 2

## 3. Recommendations for Action

## a. Short-Term

- 1) Original parties reaffirm commitment to making the procedure work
- 2) Require prejob conference to discuss jurisdictional issues before work begins
- 3) Both sides commit to compromise and change, and recognize their common goals of:
  - a. Preserve existence of union contractors and unions through sound business practices
  - b. Agree to design a fair, equitable and enforceable system, binding upon all construction participants

COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## b. Long-Term

- 1) Union presidents charge Building & Construction Trades Dept. to redefine work rights of each union for the 1980's and beyond
- 2) NLRB establish precedent to force all jurisdictional cases to first be heard by the IJDB or a similar procedure, set up by the construction industry. Decisions may be appealed as follows:
  - a. To the JAC for review of procedural considerations. In absence of new, relevant facts or gross procedural errors; decision stands.
  - b. Subsequent appeal, similar to that of Supreme Court to a restructured NLRB viewed as impartial by both sides.
  - c. All appellate levels must use the same weighted decision criteria.

COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 3) Owner become involved in jurisdictional disputes and require, via contractual language, that all disputes go to the IJDB or its successor

COMMENTS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Page 3

- 4) New alternative to NLRB should modify existing IJDB to include:
- a. Decision are court enforceable
  - b. Universal stipulation(achieved through owners)
  - c. Decisions set national precedent
  - d. Apply weighted decision criteria
  - e. 91-level appeal procedure
  - f. Expeditionis procedure (72 hours)
  - g. Penalties for job action

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- 5) Consider application of some useful principles from currently functioning plans, such as NYC plan
- 6) Commit to National Construction Employers Council (NCEC) Statement of Principles, dated 9/9/81

COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

ADDITIONAL COMMENTS:  
Item Number

### Comments

[illegible]



Industry Comments

QUESTION 1

Stumbling block is labor afraid of losing jurisdiction of present work.

I think there is a reluctance to change. I'm not sure your reason is correct.

I don't believe (b) is accurate.

AGC at the national level has withdrawn from the IJDB because meaningful changes could not be agreed upon.

I do not believe this is true as stated.

Finding is accurate.

Management wants basic changes in jurisdiction, not only in dispute resolution as a means to enhance productivity and competitiveness. Management won't compromise because it can't.

Concur.

QUESTION 2a

Concur. And that makes economic sense.

True, but union's interpretation of "fair" is to continue the old without change. Politically, no union can accept change if he is the one giving up jurisdiction.

All seven items make a fair statement.

All true, most important, 3, 4, 5.

QUESTION 2b

Resolution must emphasize 5g. Courts are probably too slow to solve problems, need resolution in one to three days.

International agreements and/or decisions of record should be a criteria.

Strong unions force jurisdiction into labor agreements. Sometimes conflicting. What may be applicable in Pennsylvania may not be acceptable in California. If the

established practice needs to be changed, then so be it. What took a skilled craftsman thirty to forty years ago may now be done by others due to simplification of the process.

I agree totally.

QUESTION 3a

Only if unions agree to agree.

There is probably no short term solution.

Can't bind owners (users) legally.

I agree. The employers I know also agree.

Concur.

QUESTION 3b

Concur, except the final appeal should be before the JAC, not the NLRB.

The more certainty we can get, the better. However, constantly changing work practices require great flexibility. Deferral is suppose to be the law now, but it is by no means uniformly followed. Also, appeal to the NLRB seems to me to be cumbersome and naturally involves government intervention. I would prefer binding arbitration before the IJDB, with court enforcement of award.

Only if criteria are relevant to today's market conditions.

General presidents are key to long term solution--without them nothing will work for long.

QUESTION 3b(3)

OK

Only if changes are made in the IJDB.

Owner may be the loser.

Is not usually in owner's best interest.

This is essential so that awards will in fact be binding.

No!

Concur.

## QUESTION 4

Disagree with any NLRB involvement.

b--Not acceptable to management.

I am not so sure national uniformity is either attainable or good. Even in our U.S. Courts of Appeals the circuits may differ. However, as with Supreme Court, if a decision goes to national level it should bind nationwide.

OK.

Good ideas.

## QUESTION 5 AND 6

I still doubt value of local boards.

Whatever is in being and is helpful should be used.

Concur with 5: Disagree with 6.

## GENERAL COMMENTS

The trades refuse to recognize the threat of open shop growth, and insist on fighting among themselves for shares of the decreasing pie. A major revolution, not minor modification, is necessary. AGC has pulled out of the IJDB and will take its chances with the NLRB.

An arbitrator with immediate availability and binding effect is what it all comes down to.

Jurisdiction is an emotional subject with building trades. Each union's objective is to preserve work and obtain more by taking it from a weaker union--thus disputes.

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
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4. TITLE (and Subtitle) Turbulent Vortex Flows		5. TYPE OF REPORT & PERIOD COVERED Final: Oct.1978-Sept.1981
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) P. Bradshaw, I.M.M.Shabaka, R.D. Mehta		8. CONTRACT OR GRANT NUMBER(s) N00014-78-G-0032
9. PERFORMING ORGANIZATION NAME AND ADDRESS Aeronautics Department, Imperial College of Science and Technology Prince Consort Road, London, SW7 2BY England		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR 061-256
11. CONTROLLING OFFICE NAME AND ADDRESS Office of Naval Research Code 438 Arlington, Virginia 22217		12. REPORT DATE 12 March 1982
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)  Turbulence Boundary layers Vortices		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This report presents the results of mean and fluctuating velocity measurements in three types of longitudinal vortex imbedded in turbulent boundary layers in nominally-zero pressure gradients. Vortex generators were installed upstream of the wind tunnel contraction, so that the vortices entering the working section did not have large associated total-pressure wakes.  Measurements include all three components of mean velocity, all		

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Unclassified

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20. Abstract (Continued)

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SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF AERONAUTICS

Prince Consort Road, London, SW7 2BY  
England

I.C. Aero TN 82-103

March 1982

Final Report on ONR Contract  
N00014-78-G-0032 Ref NR 061-256  
1 Oct. 1978 - 30 Sept. 1981

P. Bradshaw\*,  
I.M.M.A. Shabaka<sup>†</sup>, and R.D. Mehta<sup>†</sup>.

Abstract

This report presents the results of mean and fluctuating velocity measurements in three types of longitudinal vortex imbedded in turbulent boundary layers in nominally-zero pressure gradients. Vortex generators were installed upstream of the wind tunnel contraction, so that the vortices entering the working section did not have large associated total-pressure wakes.

Measurements include all three components of mean velocity, all second- and third-order (and a few fourth-order) mean products of fluctuating velocities, and surface shear stress, all for at least two streamwise positions for each configuration. Temperature-conditioned sampling measurements, and some flow visualization results, were also acquired.

---

\* Principal Investigator

<sup>†</sup> Research Assistants.

## SUMMARY

This report presents the results of mean and fluctuating velocity measurements in three types of longitudinal vortex imbedded in turbulent boundary layers in nominally-zero pressure gradients. Vortex generators were installed upstream of the wind tunnel contraction, so that the vortices entering the working section did not have large associated total pressure wakes. Measurements were made for

- (i) a single vortex
- (ii) a vortex pair with the "common flow" between the vortices away from the surface
- (iii) a vortex pair with the common flow towards the surface.

Measurements include all three components of mean velocity, all second- and third-order (and a few fourth-order) mean products of fluctuating velocities, and surface shear stress, all for at least two streamwise positions for each configuration. Temperature-conditioned sampling measurements, and some flow visualization results, were also acquired.

This is primarily a data report: evaluations of derived quantities (such as eddy viscosities and turbulent energy balances) are still in progress. Data tabulations are available from the authors on magnetic tape, and this, together with the journal paper now in preparation, will be the most convenient means of public access to the results.

## 1. INTRODUCTION

The measurements made under the present contract all refer to imbedded longitudinal vortices generated by skewing of the mean flow ("secondary flow of the first kind"). This kind of secondary flow arises from strong lateral deflection of - say - an initially two-dimensional shear layer, so that the initially-spanwise mean vortex lines are also skewed (in the opposite direction to the streamlines) and thus acquire a longitudinal component. Discrete longitudinal vortices arise only if the spanwise skewing varies rather sharply with spanwise distance, as in the flow round an obstacle protruding through a turbulent boundary layer (e.g. a wing body junction): however, discrete longitudinal vortices can be formed in the skewed flow over ship hulls ("bilge vortices") and the "S-bend" dorsal intakes used in three-engined aircraft.

Skew-induced vortices can be very strong, and, since the basic mechanism of generation is inviscid, they can occur both in laminar and in turbulent flows: they should be distinguished from "secondary flow of the second kind", the longitudinal vorticity induced by Reynolds stresses in three-dimensional flows, which is much weaker, being important only in very long, straight streamwise corners and confined in practice to non-circular ducts. The effect of turbulent stresses on skew-induced longitudinal vortices is to attenuate them, and the present work is a study of that attenuation in the simplest possible cases, in which pure, artificially-generated longitudinal vortices are entrained into initially two-dimensional boundary layers in nominally-zero pressure gradients. The configurations used are idealizations of those found in practice, but undoubtedly illustrate the phenomena, and the data should be useful for developing and testing calculation methods intended for real-life cases.



It is clear that the complex turbulent flows generated by the interaction of longitudinal vortices and boundary layers are not likely to be well predicted by unsophisticated calculation methods, and the lowest order of calculation method that can be seriously considered for detailed predictions is that based on term-by-term modelling of the Reynolds-stress transport equation. Therefore, the data acquired in the present work include all the measurable terms in the Reynolds-stress transport equations: terms containing pressure fluctuations are unmeasurable, but are believed to be small, with the exception of the "pressure-strain" terms, which are sufficiently large that they can be obtained with reasonable accuracy as the difference of all the other measured terms in the equations. Conventional pressure-probe and hot-wire techniques were used, statistical processing of the fluctuating signals from the hot wires being carried out digitally. Also, measurements in the twin vortex flow with the common flow upwards included simultaneous recording of velocity and temperature fluctuations in the flow when the fluid in one of the vortices was slightly heated on leaving the vortex generator, thus allowing the evaluation of temperature conditioned sampling statistics: this slightly rarefied technique proved invaluable in understanding the behaviour of the twin vortex flow.

Section 2 of this report describes the experimental techniques used, the wind tunnel and vortex generator being shown in figures 1 and 2. Sections 3, 4, and 5 present the results for the three vortex configurations, which are best described by reference to the definition sketch in figure 3 and the flow visualization results of figures 4 and 5.

## 2. EXPERIMENTAL TECHNIQUES

The 30" x 5" (762 mm x 127 mm) open-circuit blower wind tunnel shown in figure 1 was used for all measurements. The working section length is 2.9 m, and the longitudinal pressure gradient was nominally zero. One or two vortex generators of the type shown in figure 2 were mounted on the floor of the wind tunnel contraction. The circulation around the tip vortex of the delta wing is unaltered by passage through the wind tunnel contraction, but the percentage velocity defect in the wake is very much reduced, so that at exit from the 9 to 1 two-dimensional contraction we have a concentrated vortex with very nearly uniform axial velocity. (Although the contraction is two-dimensional, the vortex rapidly recovers its circular shape.)

The nominal tunnel speed for all measurements was 100 ft/sec (30 m/sec): the vortex-generator configurations were developed in a low-speed smoke tunnel at about the same Reynolds number as that encountered in the settling chamber of the main wind tunnel.

Standard Pitot tubes, three-hole Conrad yawmeters, and conventional cross-hot-wire probes driven by constant-temperature anemometers were used for the measurements. The fluctuating signals from the hot wires were recorded on analogue magnetic tape, with a bandwidth of 20 kHz, and were later transcribed to digital magnetic tape, with 10-bit digitization accuracy, for computer analysis including linearization. Data logging and analysis techniques are described in ref.1. Statistics involving both  $v$  and  $w$  component fluctuations were deduced from measurements with the probe cross wires in planes at  $\pm 45$  deg. to the  $xz$  plane, so that the difference between the wire signals was nominally  $(v + w)/\sqrt{2}$  and  $(v - w)/\sqrt{2}$  respectively.

For the temperature-conditioned sampling measurements, a spiral of electrical heating wire was placed just behind a

vortex generator, in such a way that the main part of the vortex passed inside the spiral. Thus, further downstream, the vortex fluid was heated without appreciable loss of angular momentum. A fast-response resistance thermometer, using one micron platinum wire, was attached next to the hot-wire probe, and driven by a conventional constant-current anemometer circuit, the wire current of 1 mA being sufficiently small for the response of the resistance thermometer to velocity fluctuations to be negligible.

### 3. MEASUREMENTS IN THE SINGLE VORTEX

Mean velocity measurements in the single vortex are shown in figure 6. The measurements in figure 6(a) were taken to define the initial behaviour of the vortex, with the tunnel floor boundary layer untripped: they are not, therefore, exactly consistent with the main results at stations further downstream, which were taken with a 1 mm trip wire at the contraction exit. For simplicity of understanding, the mean velocity profiles are presented as contour plots, and the effect of the anticlockwise vortex on the velocity contours is clearly seen. Figure 6(f) shows some velocity profiles, revealing very severe distortion in the outer part of the "boundary layer". However, velocity profiles near the wall all appear to satisfy the universal logarithmic law of the wall. Figure 7 shows the secondary flow velocity components, in vector form, with the longitudinal velocity contours inked in lightly for ease of reference. It is noteworthy that, as found by Shabaka (refs. 2,3) in a wing-body junction vortex, the maximum cross-flow angle occurs near the surface, while the return ( $W < 0$ ) flow at larger  $y$  is very weak. Figure 8 shows the variation of skin friction coefficient with spanwise distance at each measurement station. The measurements were obtained with Preston tubes, using the calibration of Patel (ref.4): the Preston tube relies on the law of the wall, and its use forces the law-of-the-wall velocity profiles to intersect the universal logarithmic law at a distance from the surface equal to the position of the effective centre of the Preston tube, but, as mentioned above, the velocity profiles actually follow the law of the wall rather than merely crossing it. The presence of the vortex generator generally increases the skin friction, except for the region of maximum lateral convergence (i.e. maximum  $\partial W / \partial z$ ) slightly to the right of the vortex centre.

Detailed hot wire measurements were made at two stations only, at  $x = 722$  mm and 2551 mm. Contour plots of all six independent Reynolds stresses are shown for  $x = 722$  mm in figure 9, and figure 10 shows profiles of the correlation coefficients

for the three shear stresses  $\overline{uv}$ ,  $\overline{uw}$  and  $\overline{vw}$ . Note that, here and elsewhere, the symbols on the contour plots are not original data points, but interpolated values. Turbulence statistics at each of the original data points are available on magnetic tape. As seen in figure 10(a), the primary shear stress  $-\rho\overline{uv}$  is negative over much of the left hand side of the vortex, but the actual negative values of shear stress are rather small. The contours of the secondary shear stresses are more difficult to follow, because both are nominally zero at larger distances from the vortex and both take either sign in different parts of the vortex. The fact that the vortex is spreading into the surrounding fluid and reducing its  $u$  component momentum suggests that  $\overline{uw}$  should be negative on the right hand side of the vortex (positive  $z$ ) and positive on the left hand side, as is broadly the case. The spreading of longitudinal vorticity suggests that  $-\rho\overline{vw}$  should be negative everywhere (recall that the vortex rotates anticlockwise as seen on the page). However, minor regions of opposite signs again occur. It is, of course, rather difficult to measure  $\overline{vw}$ , which is derived as the small difference of two large quantities, but the relative smoothness of the correlation coefficient profiles shown in figure 10(c) suggest that, at least, the random error in the measurements was small.

Reynolds stress measurements at  $x = 2551$  mm are shown in figures 11 and 12, and generally repeat the trends found at  $x = 722$  mm. Note that all contour plots in this report are provisional.

Figures 13 to 16 show triple and quadruple products, all in the form of profiles. The results are, of course, somewhat stupefying, but since most of the quantities involved changed sign in different parts of the vortex, contour plots would be even less suitable for assessing the trends. As an example, take the measurements of  $\overline{v^3}$  shown in figure 13(d): it represents the transport of  $\overline{v^2}$  fluctuations in the  $y$  (i.e.  $v$ ) direction. It is positive, except for regions near  $y = 10-15$  mm at  $z = -25$  mm and  $z = -35$  mm, which, as the  $\overline{v^2}$  contours in figure 9(b) indicate,

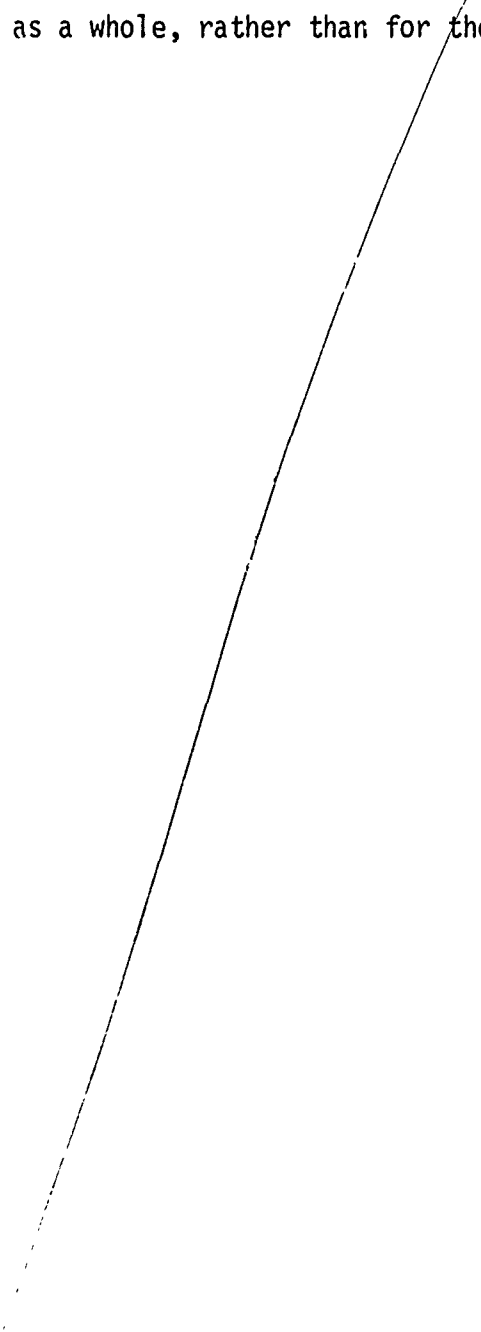
is where  $\overline{v^2}$  increases with increasing  $y$ . Again, the large values of  $\overline{v^3}$  near  $y = 30$  mm at  $z = -15$  to  $-35$  mm corresponds to the large negative values of  $\partial\overline{v^2}/\partial y$  at the edge of the vortex.  $\overline{u^2v}$ , shown in figure 13(b), represents the  $y$  component transport of  $\overline{u^2}$ , and the large positive values at  $z = -15$  mm for all  $y > 10$  mm again correspond to a strong upward displacement of the intensity contours (figure 9(a)) as in the case of  $\overline{v^2}$ . In general, then, the triple products behave qualitatively as would be expected from a "gradient diffusion" model, large values occurring in the same place as large gradients of the relevant Reynolds stress. However, it is quite clear that, as in Shabaka's wing body junction vortex experiment, gradient diffusion models are inapplicable in detail.

Skewness and flatness factors (i.e. dimensionless third and fourth order mean products) were obtained for all three velocity components, but here we show only the  $v$  component skewness (to tie up with the discussion of  $\overline{v^3}$  above) and the  $u$  component flatness: the latter appears somewhat random, but in fact corresponds roughly to the usual expectations that the flatness factor shall be approximately equal to  $3/\gamma$ , where  $\gamma$  is the intermittency factor discussed below.

Figures 15 and 16 show the triple products, skewness and flatness at  $x = 2551$  mm.

Figure 17a shows the intermittency factor, deduced from measurements with the vortex slightly heated, using the algorithm described by Muck (ref.5). It was hoped to be able to distinguish the vortex fluid from the surrounding boundary layer fluid as well as the free stream fluid, but in fact the results outside the region shown in figure 17a are unreliable because of background temperature fluctuations in the boundary layer. However, the fact that the spacing of the intermittency contours is about the

same on the side of the vortex and on its top, confirms the impression from previous results that the vortex is not wandering significantly from side to side. Figure 17(b) shows the intermittency deduced from the velocity fluctuation field at  $x = 2551$  mm. This, of course, is the intermittency factor for the turbulent fluid as a whole, rather than for the vortex fluid as in figure 17(a).



#### 4. MEASUREMENTS IN THE VORTEX PAIR WITH "COMMON FLOW" UPWARDS

Mean velocity contours for this flow are shown in figure 18. It is obvious at once that the vortex centres are much further from the surface than in the case of the single vortex, because each vortex induces a positive  $V$  velocity on the other. Also, in contrast to the single vortex whose circulation remains almost constant down the length of the flow, the circulation of each vortex of the pair decreases because of diffusion into the other and the secondary flow therefore dies out rather rapidly. The shape of the velocity contours is plausible, but figure 18(d) shows that some of the individual velocity profiles have even odder shapes than in the single vortex flow. Figures 19 and 20 show the  $V$  and  $W$  component velocity profiles, at  $x = 900$  and  $1350$  mm. A slight decrease in secondary flow is seen between the two stations, but mutual annihilation of the vortices is certainly not complete by  $x = 1350$  mm, and measurements were terminated here simply because the vortex pair was approaching the roof of the wind tunnel ( $y = 127$  mm). We shall see below that the amount of diffusion of the fluid from one vortex into the other is in fact rather small, and that, because the vortices remain at some distance from the surface, they extract turbulent fluid from the boundary layer rather than strongly interacting with it. Figure 21 shows the variation of skin friction coefficient with  $z$ , including some results at  $x = 1450$  mm: as in the case of the single vortex the skin friction coefficient is increased over most of the flow, but with a dip in the region of maximum convergence of the flow near the surface (i.e. maximum negative  $\partial W / \partial z$ ). The curious secondary peak at  $x = 600$  mm was not found at the other stations.

Figure 22 shows the six Reynolds stresses at  $x = 900$  mm. Near the surface, the contours of each of the three mean square intensities show the minimum at the centre line, with maxima either side, implying that the fluid which has travelled laterally near the surface before being "extruded" along the vertical centre



line has lost a good deal of its intensity, possibly because of the direct effect of lateral convergence on turbulent structure. Further from the surface, a tongue of high intensity fluid projects up the vertical centre line, and  $\overline{v^2}$  and  $\overline{w^2}$  have maxima at  $y \approx 45 \text{ mm}$ ,  $\pm 25 \text{ mm}$  from the centre line, which may plausibly be assumed to be the positions of the vortex cores. The absence of a corresponding peak in  $\overline{u^2}$  is intriguing, and suggests that the large lateral and vertical component intensities result from "snaking" of the vortex cores rather than from genuine turbulence (since the  $U$  component mean velocity is nearly constant over the vortex cores, "snaking" would not produce sympathetic variations of  $u$  component velocity). The primary shear stress  $-\rho\overline{uv}$  is either zero or even negative over most of the vortex region, except very close to the centre line where boundary layer fluid is drawn out from the surface without being rotated about the  $x$  axis, so that its  $uv$  correlation is preserved. The negative values occur, roughly, where  $\partial U/\partial y$  is negative and can therefore be qualitatively explained on "gradient diffusion" arguments: the corresponding values of shear correlation coefficients are quite large.  $-\rho\overline{uw}$  has a sign, near the surface, consistent with lateral diffusion of the region of low  $u$  component velocity near the surface, and the same is true, over a limited range of  $z$  encompassing the outwards-going "tongue" of fluid, at larger distances from the surface. Values of  $\overline{uw}$  in the vortex cores are very small. Values of  $-\rho\overline{vw}$  are generally of the sign predicted by gradient diffusion arguments based on the behaviour of  $\partial V/\partial z$ ,  $V$  having a positive maximum on the vertical centre line. Figure 23 shows that the correlation coefficients for all three components of shear stress are quite large, and even  $R_{vw}$  reaches  $\pm .4$ .

Figures 24 and 25 show measurements of the Reynolds stresses at  $x = 1350 \text{ mm}$ , which broadly followed the measurements at  $900 \text{ mm}$ .

Figure 26 shows the triple products  $x = 900$  mm, and again the apparent complication hides a rough approximation to "gradient diffusion" behaviour, both near the surface and, at least for a few values of  $z$ , near the vortices: however, the  $z$  wise spacing of the profile is rather too large to establish trends clearly. Those triple products that are allowed by symmetry to be non-zero on the centre line (i.e. those not containing odd powers of  $w$ ) have significantly non zero values, most noticeable in  $\overline{w^2 u}$ .  $\overline{v^3}$  has negative values at  $y \approx 45$  mm ( the height of the vortex cores) at positions slightly off the centre line: inspection of the  $\overline{v^2}$  contours reveals that  $\partial \overline{v^2} / \partial y$  is indeed negative in these regions. The  $v$  component skewness values shown in figure 27 are numerically quite large in this region. Again in spite of appearances, the  $u$  component flatness factor shown in figure 27(b) is roughly equal to  $3/(\text{intermittency factor})$ .

Figure 30 shows the temperature intermittency and the mean temperature profile for three values of  $z$  in the flow with the right hand vortex heated. The results are remarkable, showing that virtually none of the heated fluid has reached the centre line (much of the small temperature excursion  $z = 10$  mm being attributable to natural heating of the boundary layer fluid which is then drawn away from the surface). The results also suggest that the centre of the vortex is rather further from the centre line than the region of maximum  $\overline{vw}$  intensity. Clearly, it will be quite difficult to predict the diffusion of mass and momentum in a double vortex flow with sufficient accuracy - say - the 60 deg. sector distortion at the bottom of an S-bend aircraft engine intake.

A critical part of the development of a transport equation calculation method for flows of this kind is the modelling of the triple products. Further calculations of triple products transport coefficients have been made, but analysis is still in progress and the interim results are not presented here: they are on the data tape.

5. MEASUREMENTS IN A VORTEX PAIR WITH THE COMMON FLOW TOWARDS THE SURFACE.

It was intuitively expected, with some support from preliminary flow visualization, that this flow would be roughly equivalent to that in two isolated vortices, with some effect of lateral divergence of the flow on the boundary layer between the vortices. Therefore, we at first proposed to investigate this flow less thoroughly. However, preliminary quantitative measurements showed that, in this configuration at least, the separation between the vortices does not grow sufficiently rapidly for them to become "isolated". Therefore, the experimental work on this flow is being carried on after the end of the contract, by Dr. Alaa Shibl a Sabbatical visitor from Riyadh, Saudi Arabia, without cost to ONR. The measurements presented here represent a fairly full coverage of one streamwise station, and measurements for a second streamwise station (actually further upstream) are now in progress. In this flow, spanwise gradients near the centre line are small, in contrast to the situation in the twin vortex flow with common flow upwards, and, after initial symmetry checks, most of the measurements have been made only for  $z > 0$ .

Figure 31 shows mean velocity contours for the whole flow, with greater resolution for  $x > 0$ . The asymmetry of the velocity contours in the vortex region is in the same sense as in the isolated single vortex flow. There is no significant region near the centre line in which the velocity profiles are independent of  $z$ , which immediately shows that our original expectation /hope that the central boundary layer would be collinearly divergent except near the vortices is not fulfilled. The centre plane boundary layer is obviously slightly thinner than the asymptotic boundary layer for large ( $z$ ) but this is to be expected in any case. Figures 32 and 33 show the  $V$  and  $W$  component velocities, measured with hot wire probes. As usual with hot wire measurements, the absolute values of the velocities are in doubt but comparative

values should be reliable: in fact, it appears that  $W$  is too large by very roughly  $0.01 U_e$  (since it should be zero at  $z = 0$ ) while  $V$  is probably too large by about  $0.03 U_e$  (since at large  $z$   $V/U_e$  at the edge of the boundary layer should be equal to  $d\delta^*/dx$ , which is about 0.002).

Figure 34 shows the spanwise variation of skin friction coefficient, which again confirms that there is no significant region of spanwise-independent flow near the centre line: as in previous cases, there is an overall increase in skin friction near the vortices, except at  $x \approx \pm 100$  mm, where the flow is converging naturally and moving away from the surface. The skin friction coefficient near the centre plane is somewhat higher than at large distances from the vortices, but by an amount that can be explained almost entirely by reduction in momentum thickness Reynolds number without the need to invoke the effect of lateral divergence on the turbulent structure itself. However, Brederode and Bradshaw (ref.6) found that mild lateral convergence or divergence did have a significant effect on turbulence structure, and we shall bear this point in mind in further analysis.

Figure 35 shows the Reynolds stress contours, which are qualitatively unremarkable to a reader familiar with the results for the single isolated vortex. Figure 36 shows the correlation coefficients for the three shear stresses, of which that for  $\overline{vw}$  is small, both compared to the other two for this flow and compared to  $R_{vw}$  in the twin vortex with common flow away from the surface.

Figure 37 shows the triple products, and here there is some suggestion that the boundary layer between the vortices has a turbulent structure significantly different from that in the nearly two-dimensional flow far from the vortices: for instance, figure 37(d) shows that  $\overline{v^3}$  is considerably larger in the centre-

plane boundary layer, although the main difference in the skewness (figure 38) is confined to the inner part of the boundary layer  $y < 35$  mm, say. Once more, the general behaviour of the triple products is that expected qualitatively from gradient diffusion arguments, and once more one expects that these arguments will not be quantitatively acceptable. An incidental cross check on the accuracy of the results for higher order parameters is provided by the measurements of  $\overline{w^3}$  at  $z = 0$ , which should be, and very nearly are, zero by symmetry.

### Conclusions

At the time of writing, work on data analysis is continuing without cost to ONR, both at Imperial College (Professor Bradshaw, Dr. Shibl) and by Dr. Mehta, now working at NASA Ames Research Center. We have drawn provisional conclusions about the behaviour of the three vortex flows, based on the simple statistical quantities presented here, but derived results, especially the terms in the Reynolds-stress transport equations, are needed to test and amplify the flow model. Therefore the main conclusion of this Final Report is that the data presented herein are a self-consistent and reliable documentation of idealized versions of the three commonest examples of longitudinal vortices imbedded in plane boundary layers. Together with the extensive wing-body junction data of ref.3, the present data should provide adequate material for developing and testing better calculation methods for skew-induced secondary flow. At the recent AFOSR-HTTM-Stanford conference on computation of complex turbulent flow, this common kind of flow caused great difficulty to existing calculation methods.

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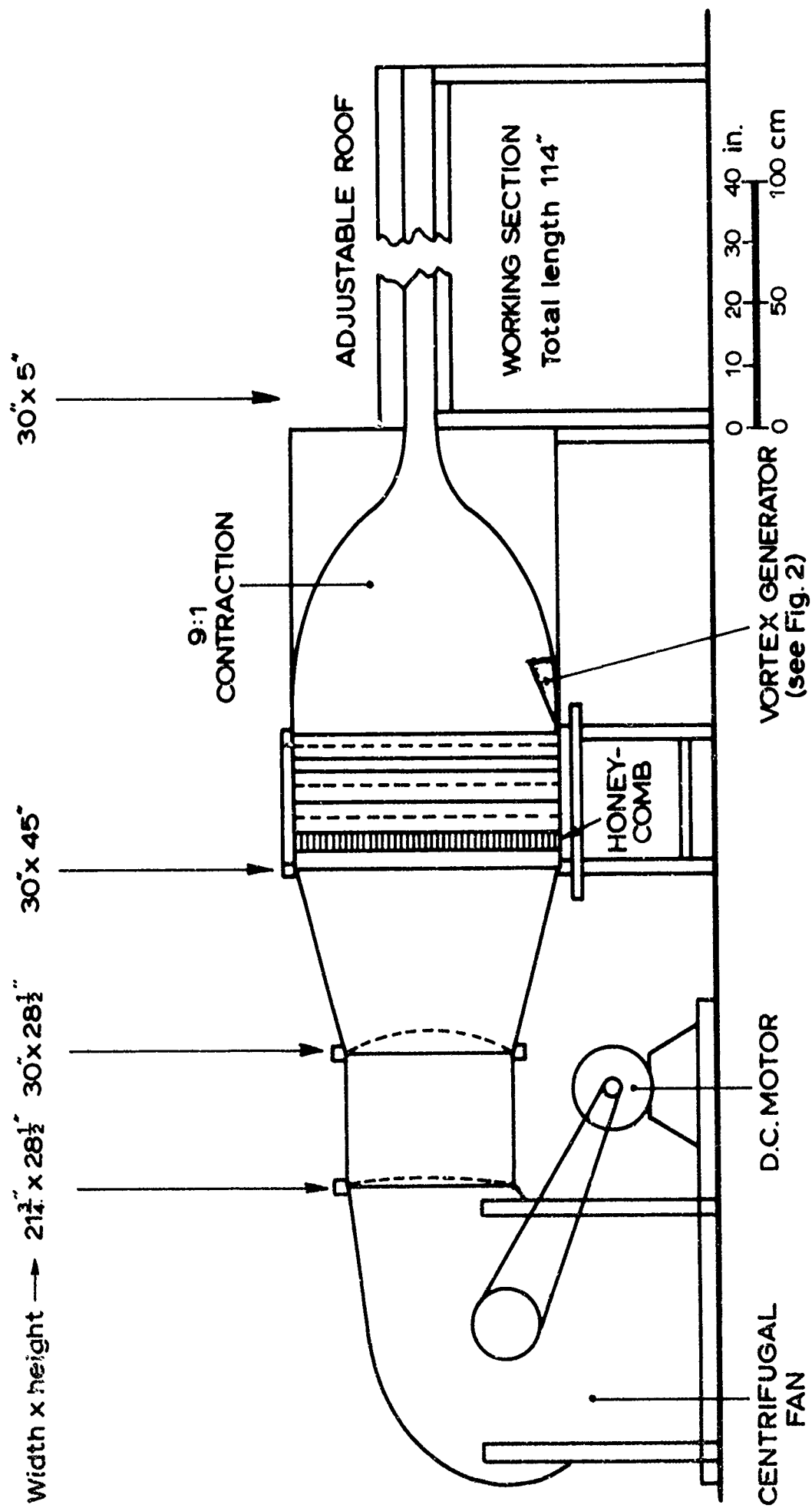


Fig.1 SIDE VIEW OF TUNNEL WITH BOUNDARY LAYER TEST SECTION; DOTTED LINES INDICATE SCREENS.

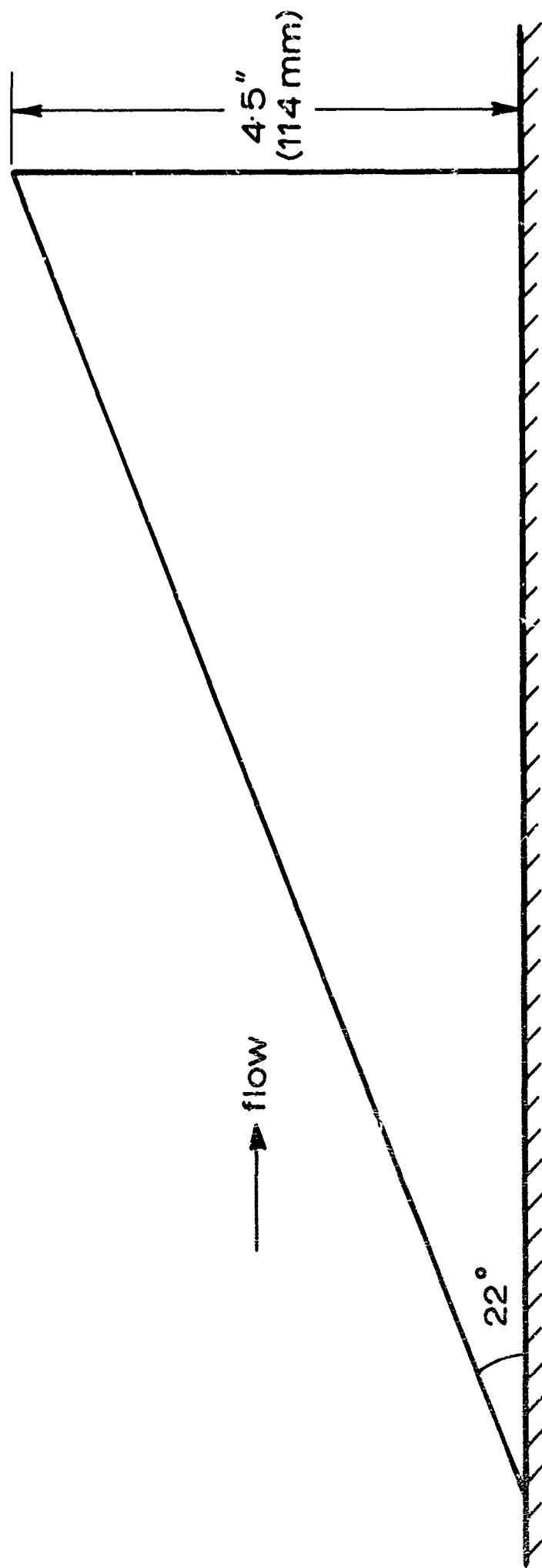
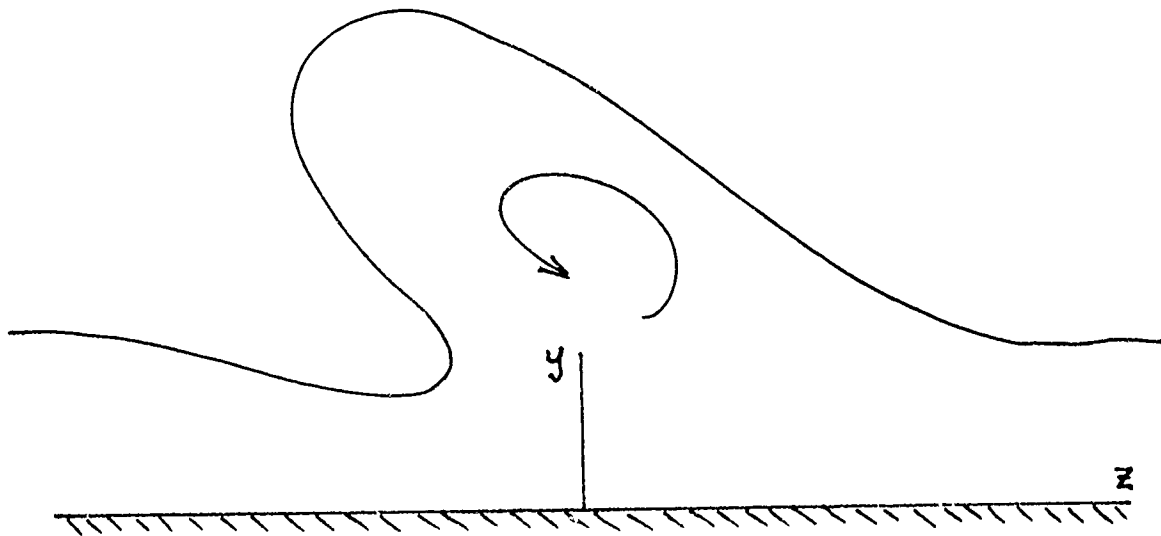
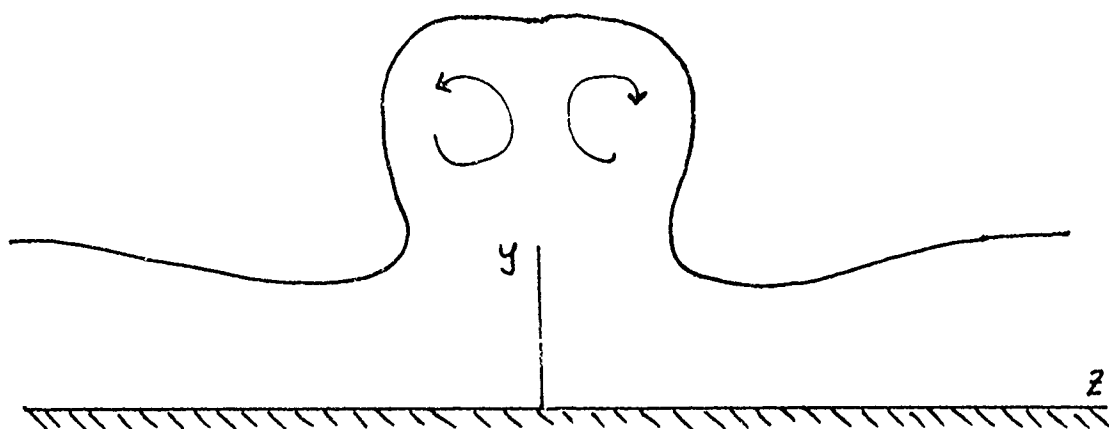


Fig. 2 VORTEX GENERATOR  
- incidence 12°

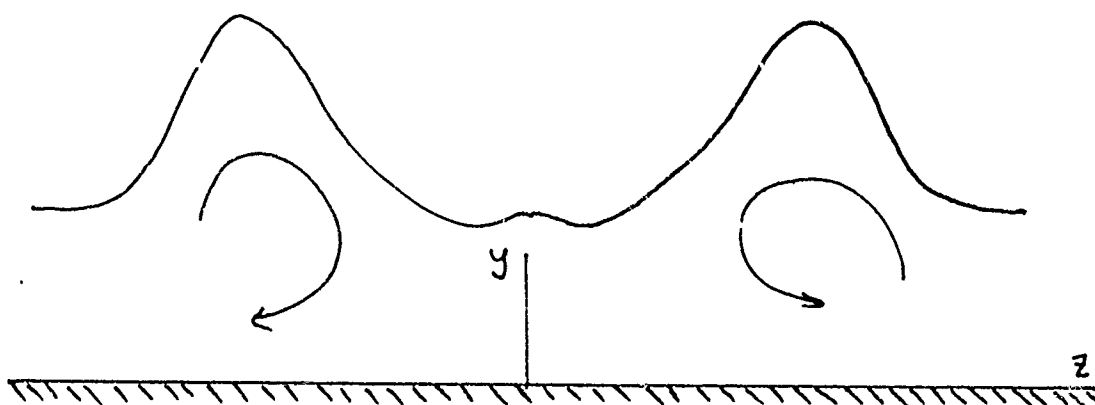




3(a) Single vortex (Figs. 6-17)

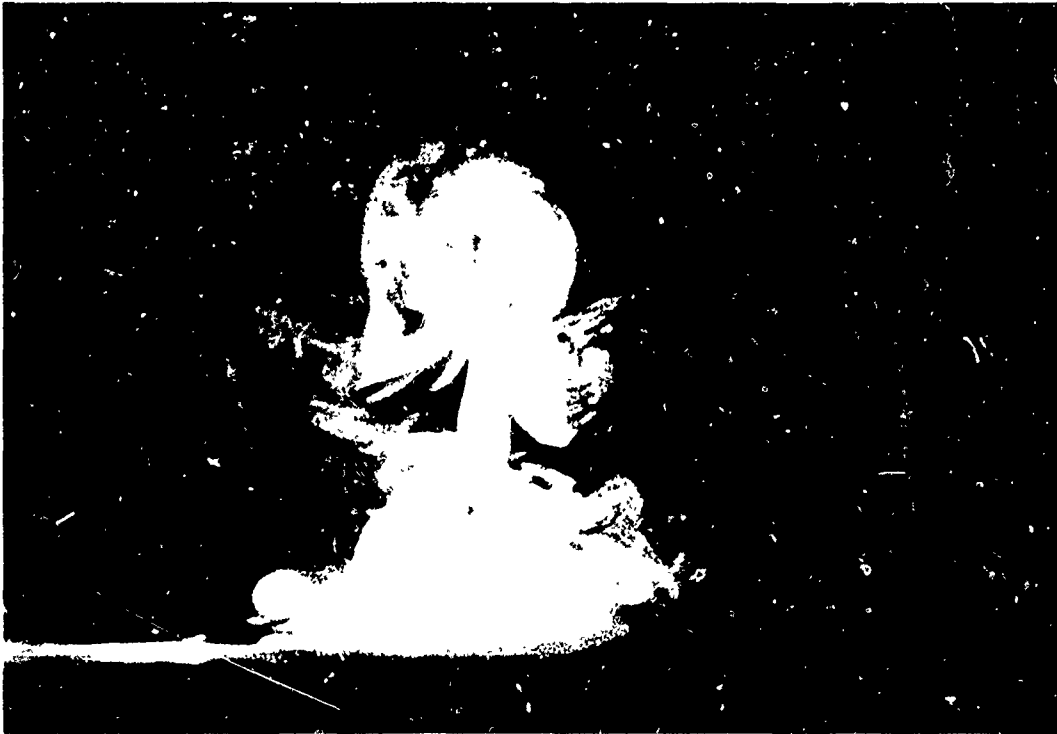


3(b) Double vortex, common flow upwards (Figs. 12-30)



3(c) Double vortex, common flow downwards (Figs. 31-38)

Fig.3 Imbedded-vortex configurations



4(a) Smoke photograph of double vortex.  
Common flow moving away from the surface.



4(b) Smoke photograph of double vortex.  
Common flow moving towards the surface.

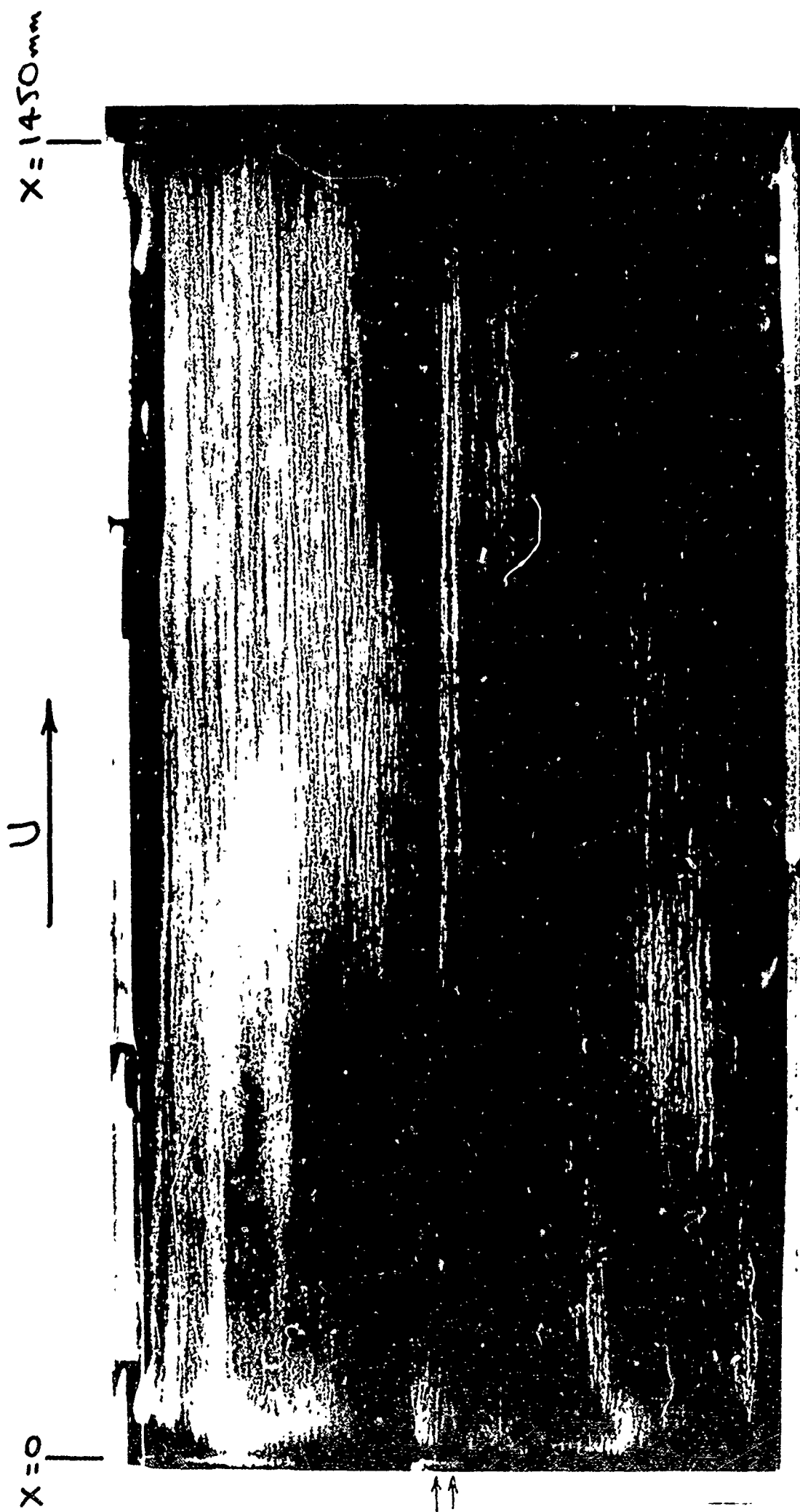


Fig. 5(a) Oil-flow visualization in double vortex  
( $U$  ) - common flow away from the surface

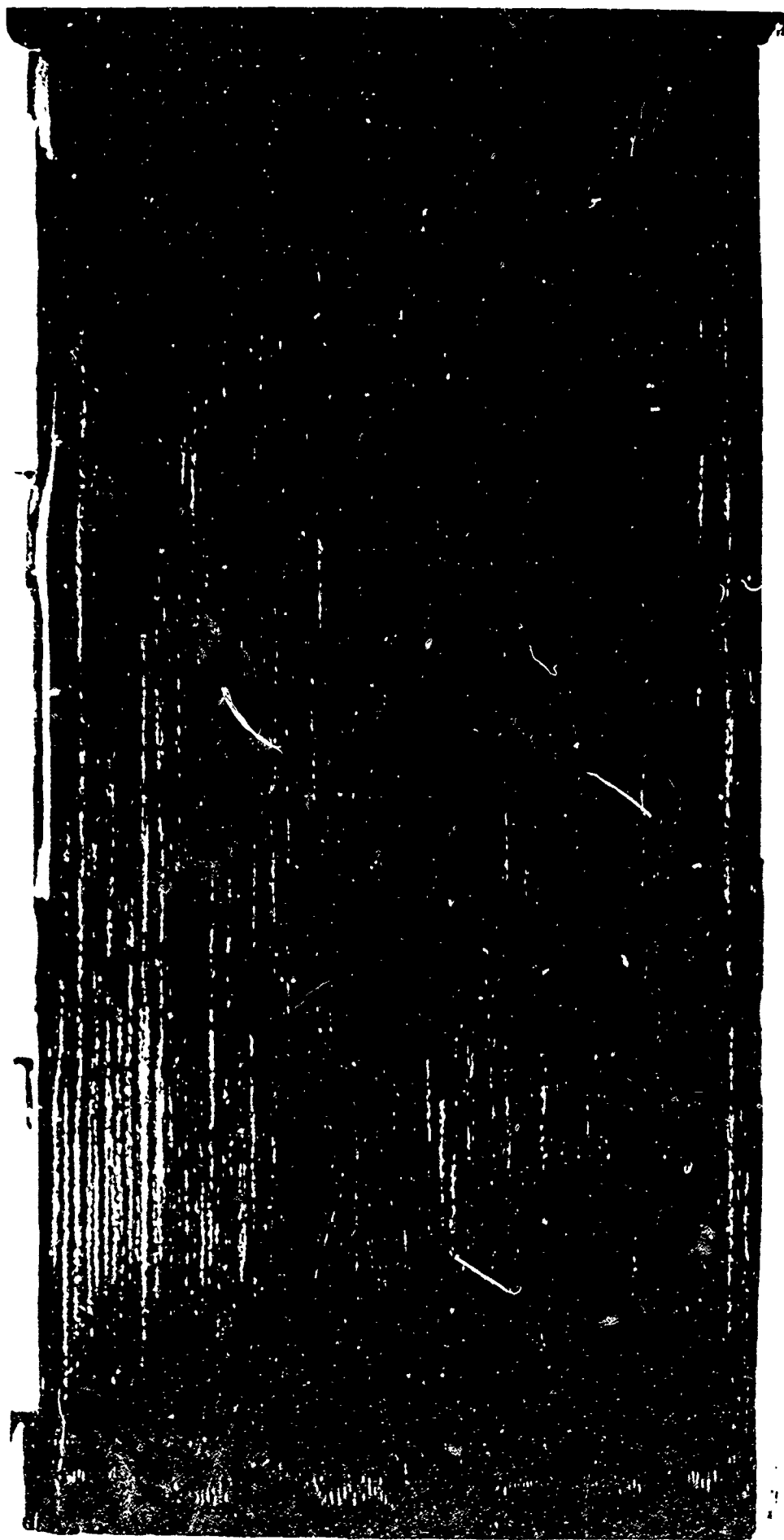


Fig.5(b) Oil-flow visualization in double vortex  
( ) ( ) - common flow towards the surface



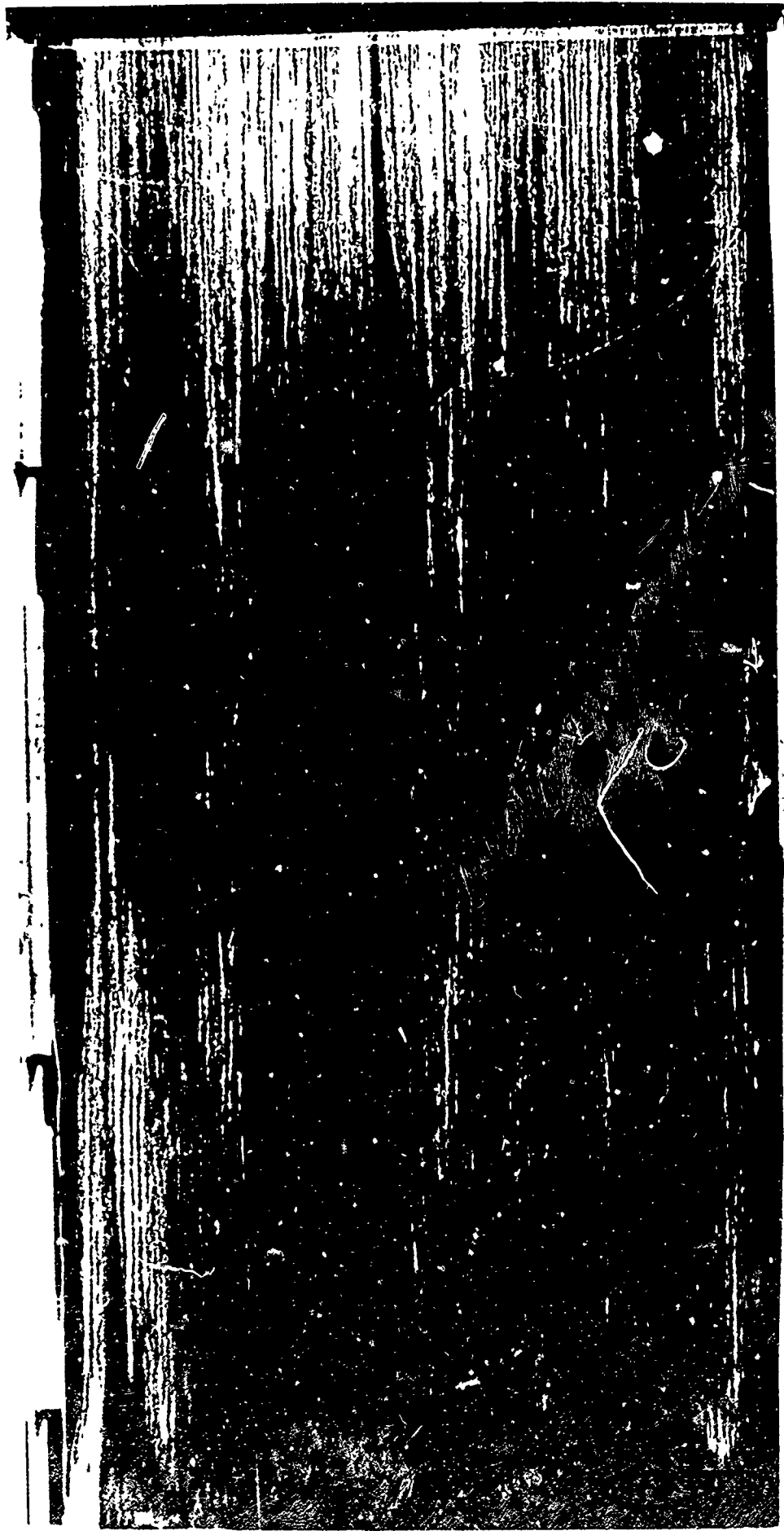


Fig. 5(c) Oil-flow visualization in single vortex (3°)

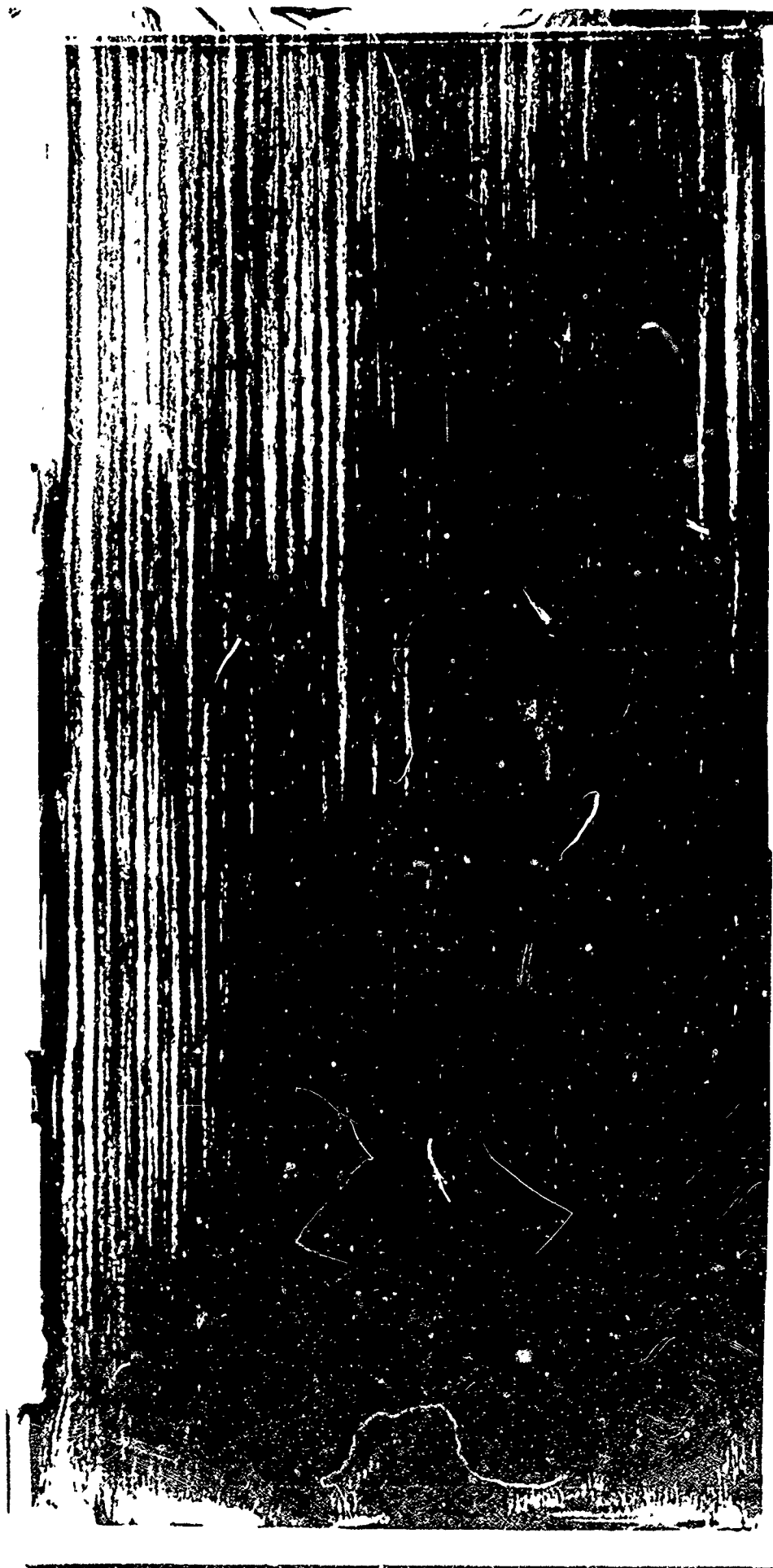


Fig. 5(d) Oil-flow visualization in a nominally 2-D boundary layer - without any vortex generators.

Figures 6-17 Single vortex

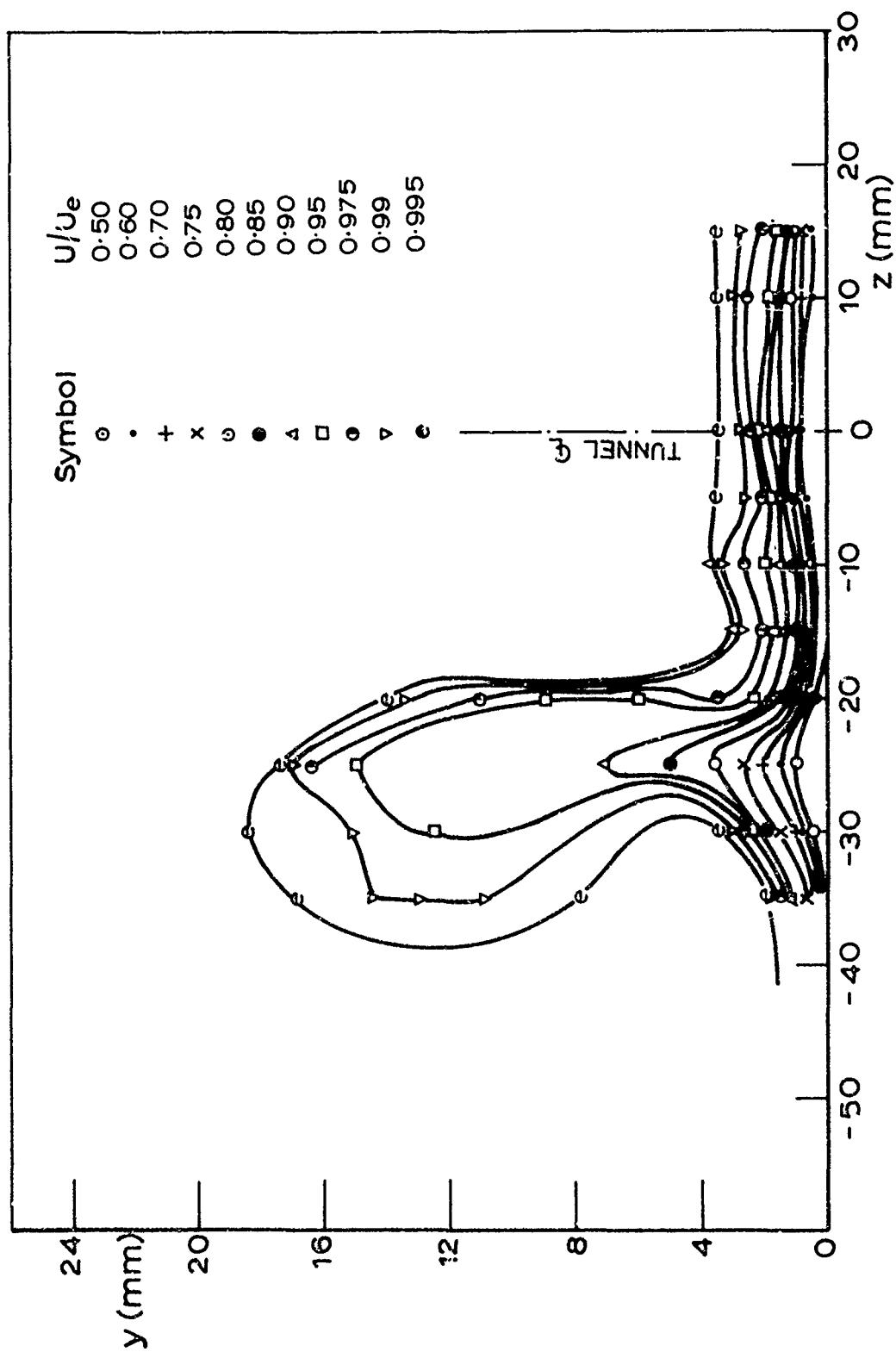


Fig. 6(a) Velocity contours at Station 1 ( $x=112.4$  mm)  
(Boundary layer not tripped)

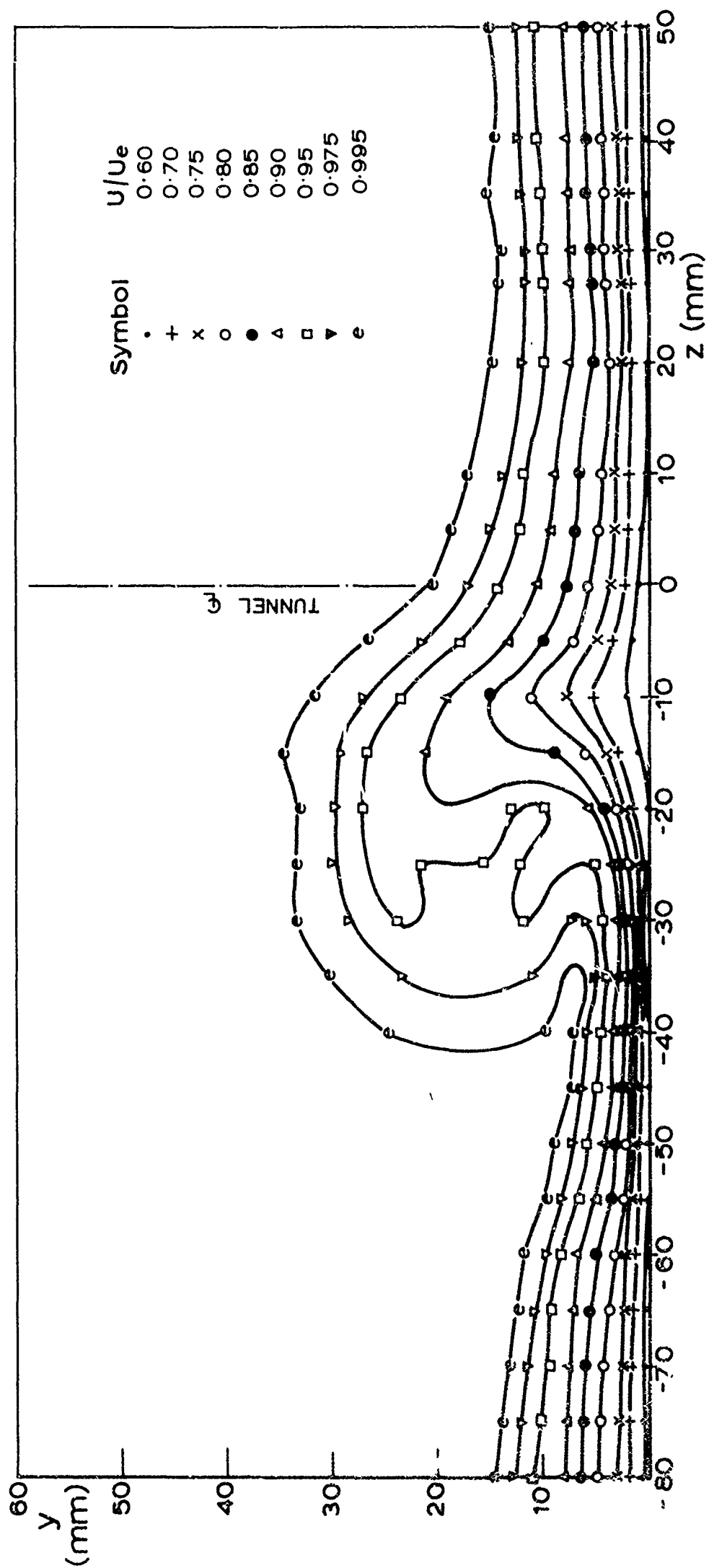


Fig. 6(b) Velocity contours at Station 5 ( $x=722$  mm)  
(Tripped boundary layer)



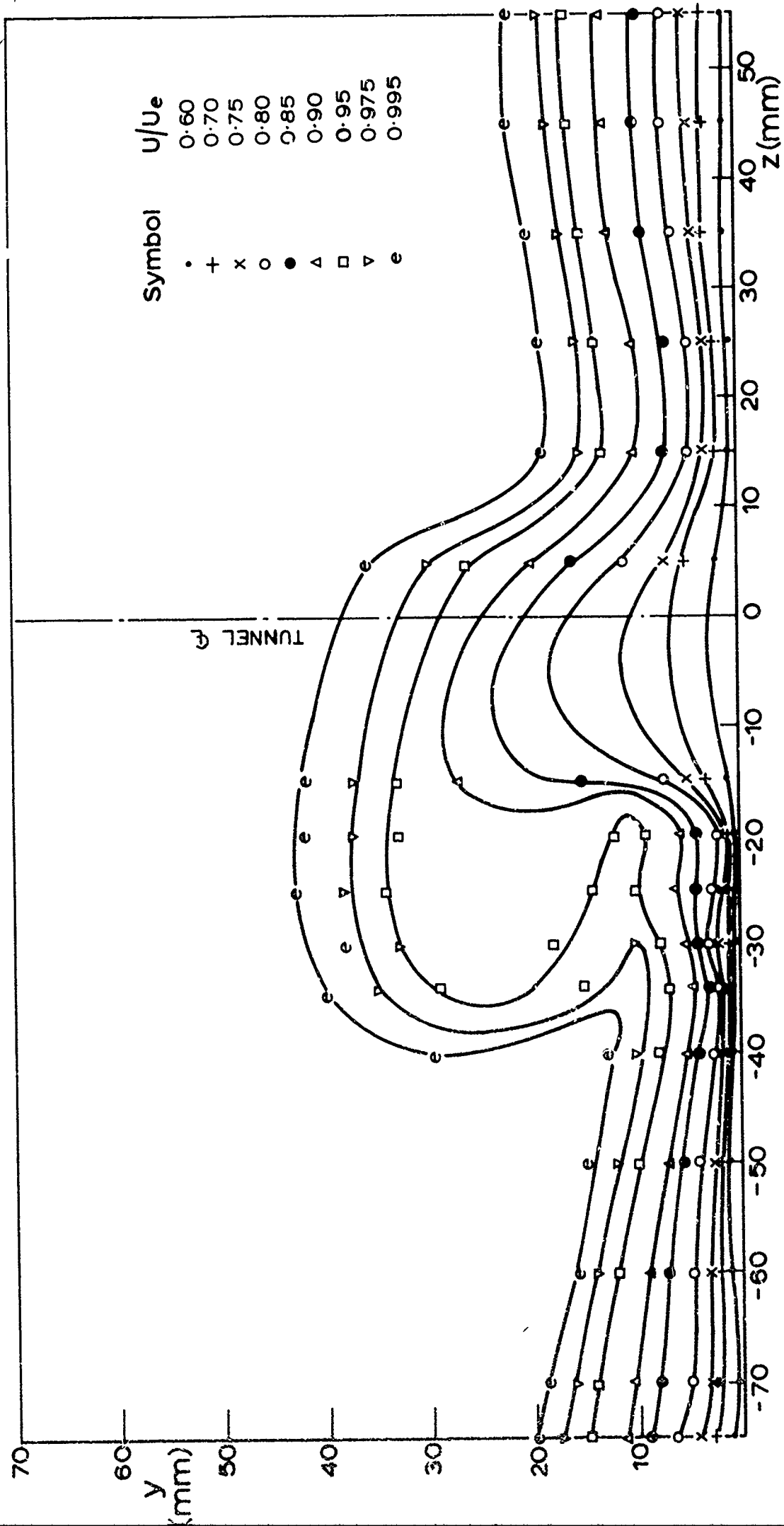


Fig. 6(c) Velocity contours at Station 9 ( $x=1331.6$  mm)

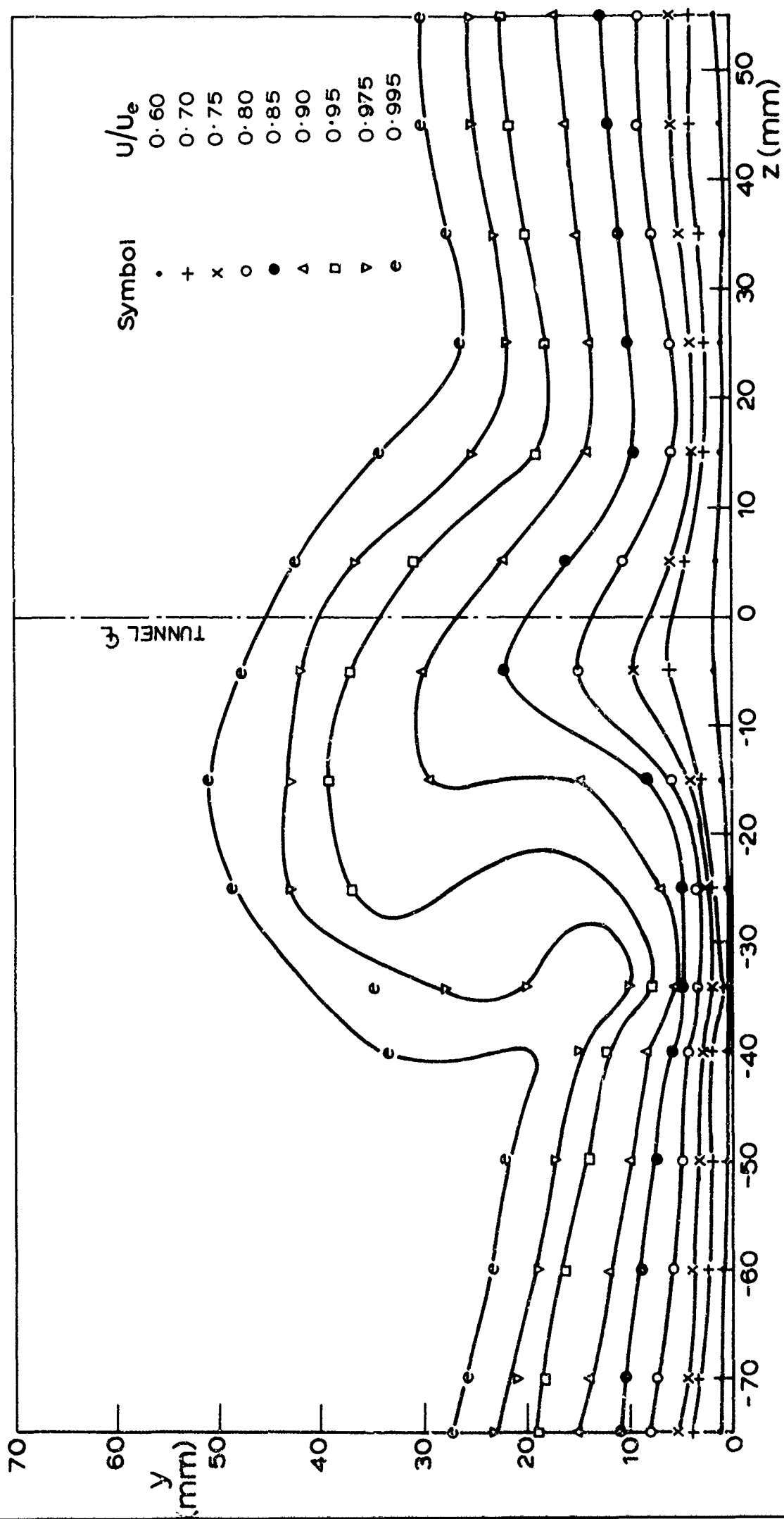


Fig. 6(d) Velocity contours at Station 13 ( $x=1941.2$  mm)

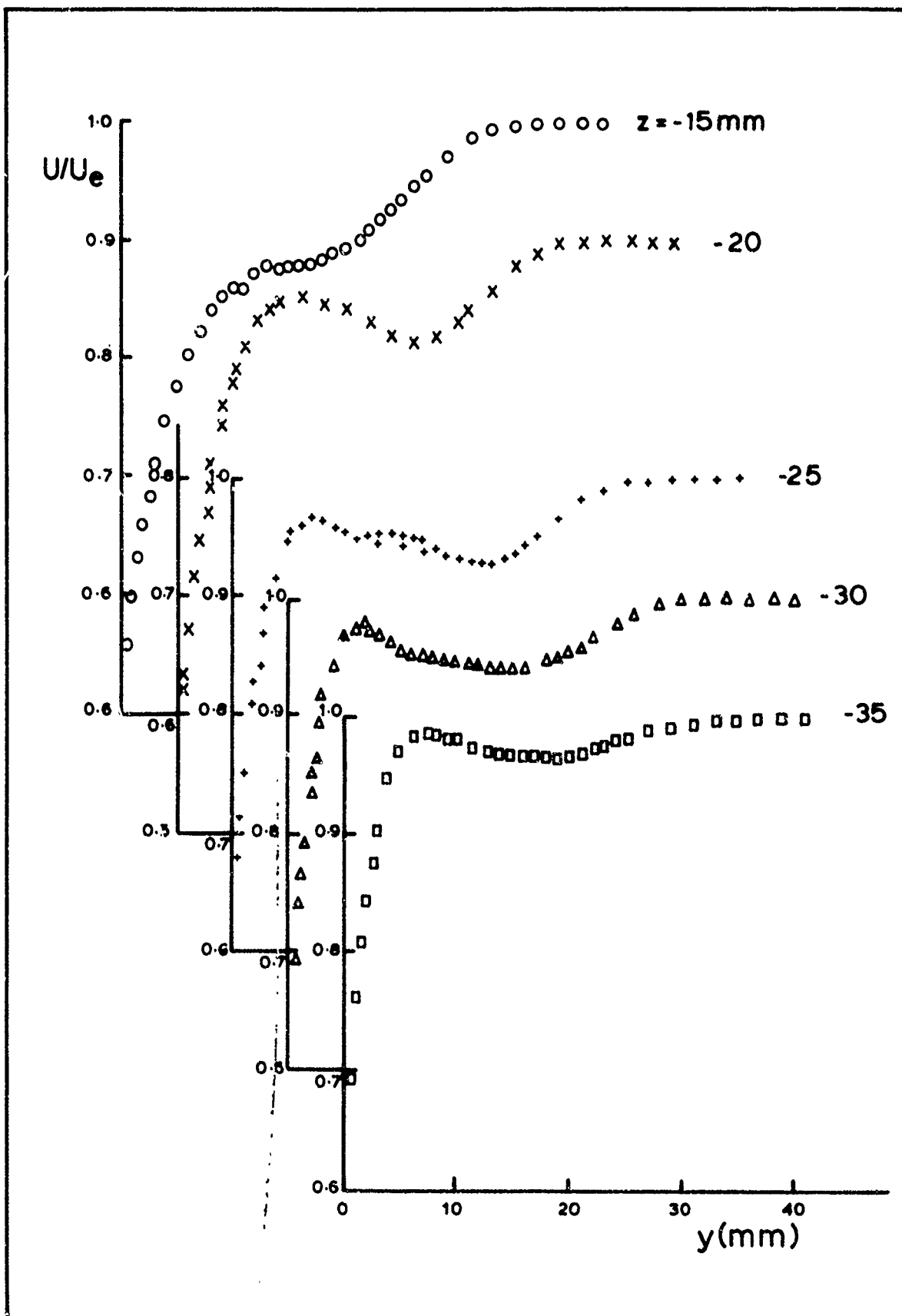


Fig. 6(f) Some distorted velocity profiles: Station 5  
( $x=722$  mm)

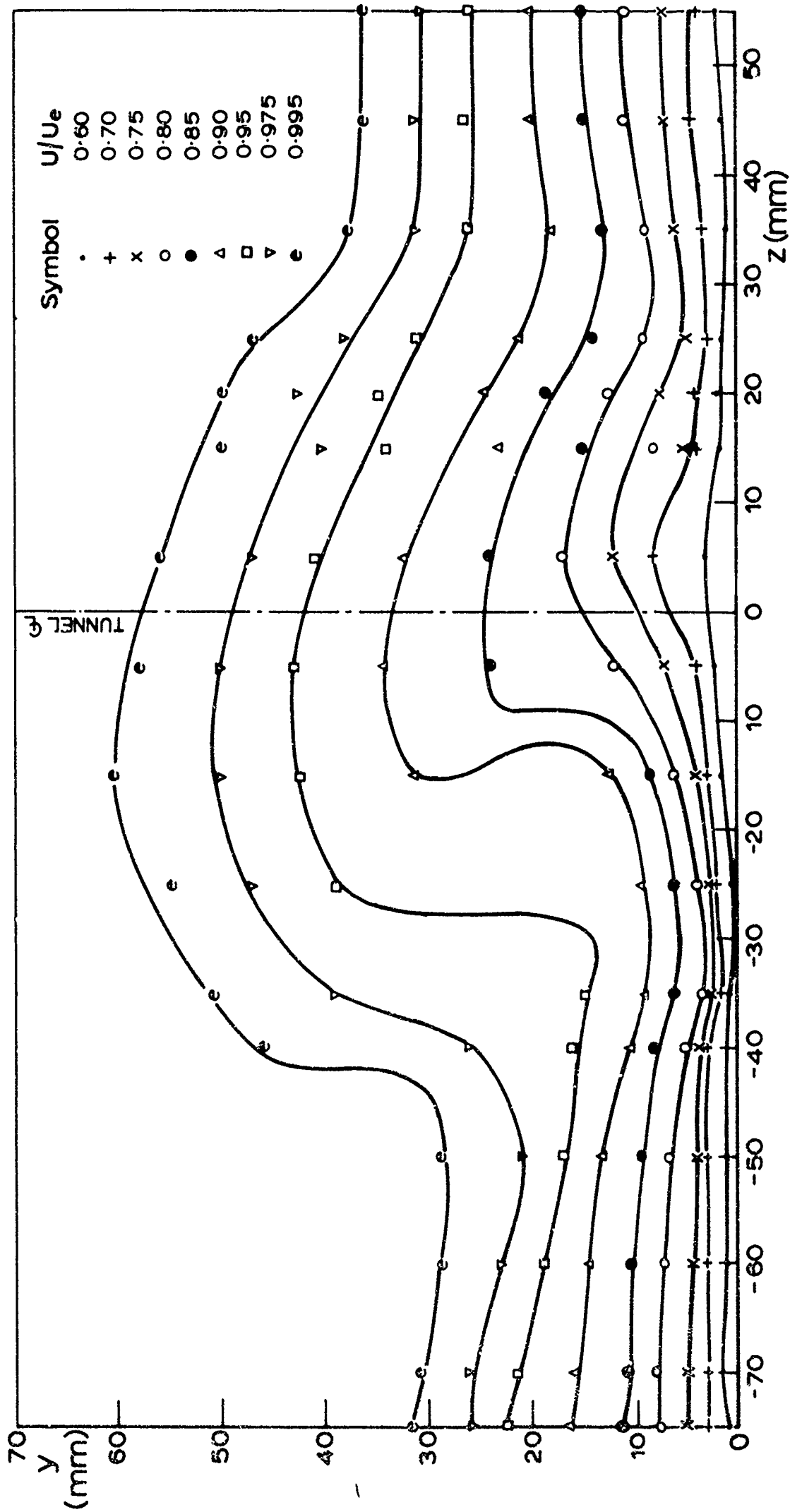


Fig. 6(e) Velocity contours at Station 17 ( $x=2550.8$  mm)

Jan. 2. 1977

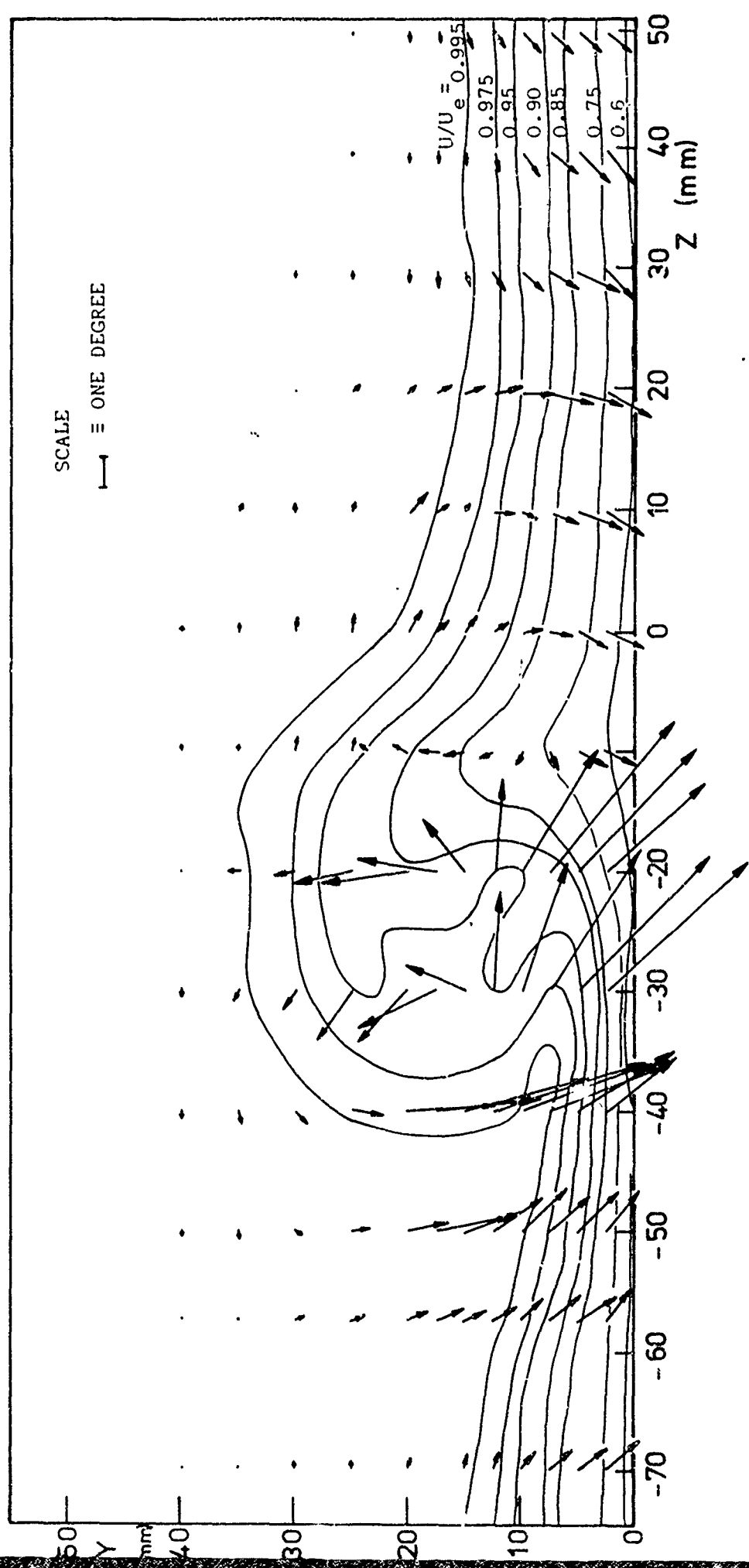


Fig. 7(a) SECONDARY FLOW VECTORS AT STATION 5 ( $x = 722$  mm)  
 (ARROW LENGTH REPRESENT TANGENT OF FLOW ANGLE,  $\sqrt{v^2 + w^2}/U$ )

Jan 11, 19

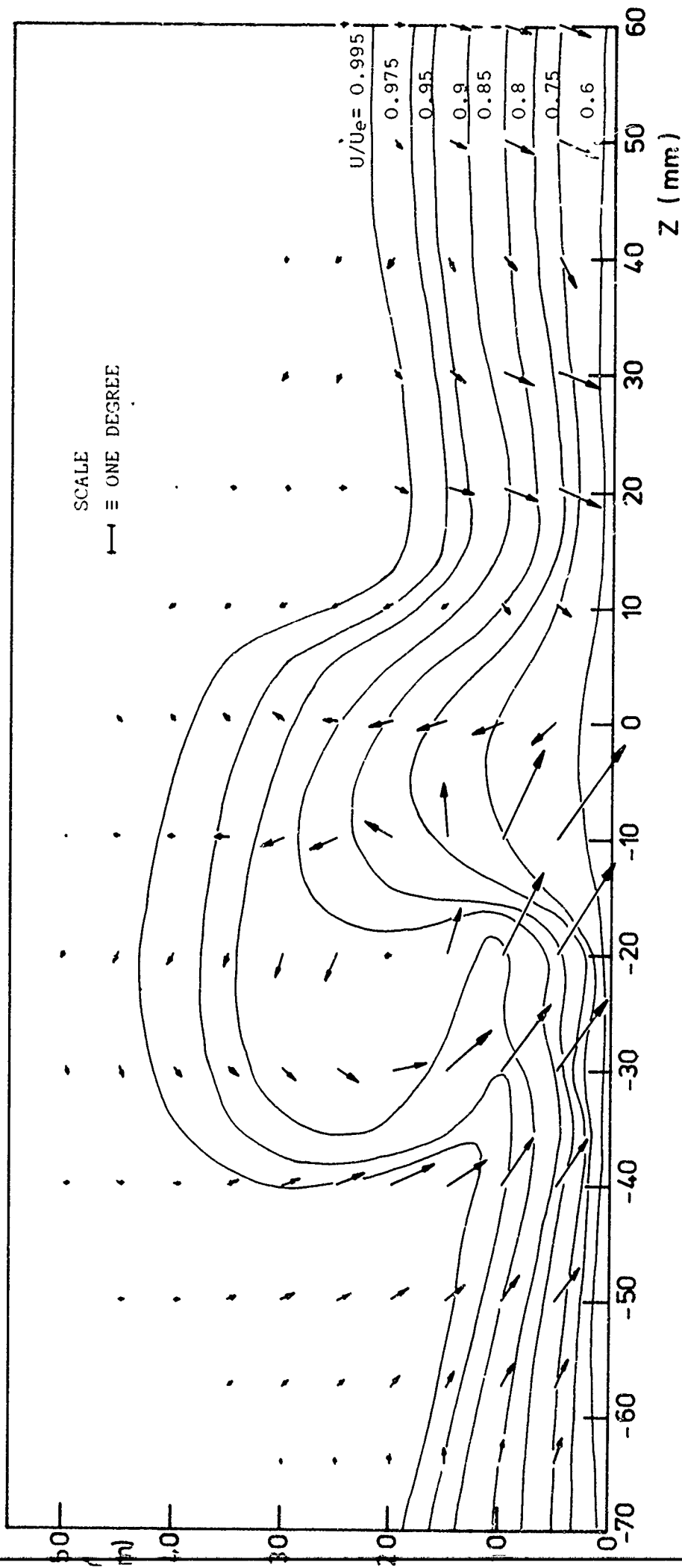


Fig. 7(b) SECONDARY FLOW VECTORS AT STATION 9 ( $x = 1331.6$  mm)  
(ARROW LENGTH REPRESENTS TANGENT OF FLOW ANGLE  $\sqrt{v^2 + w^2}/U$ )

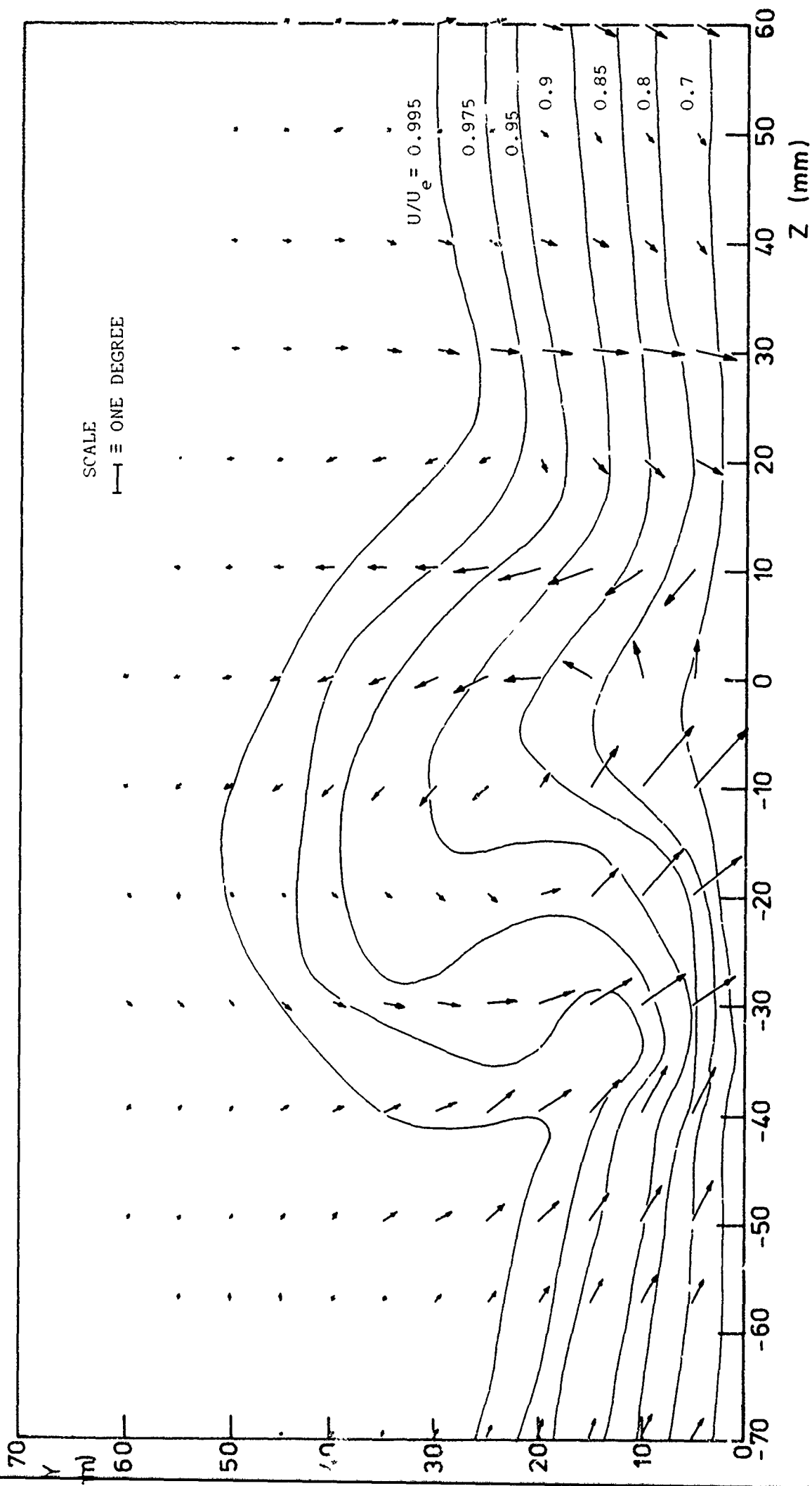


Fig. 7(c) SECONDARY FLOW VECTORS AT STATION 13 ( $x = 1941.2$  mm)  
(ARROW LENGTH REPRESENTS TANGENT OF FLOW ANGLE  $\sqrt{v^2 + w^2}/U$ )

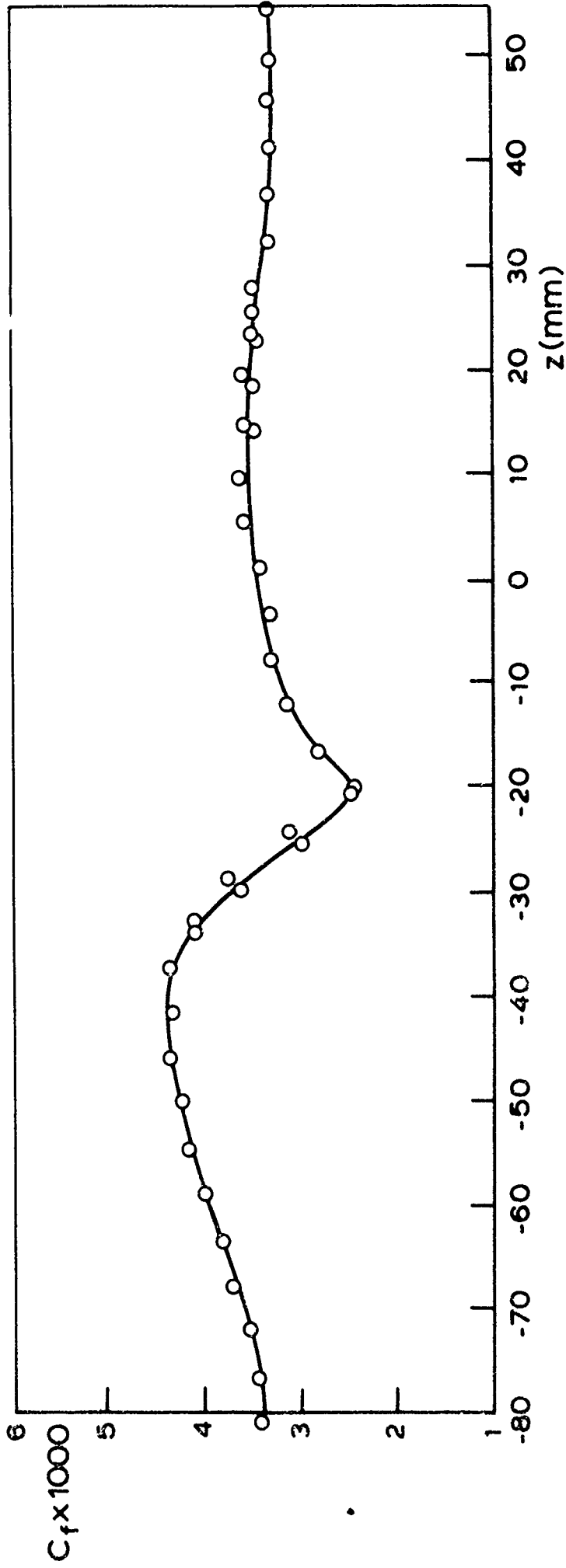


Fig. 8(a) Skin friction coefficient at Station 5 ( $x=722$  mm)



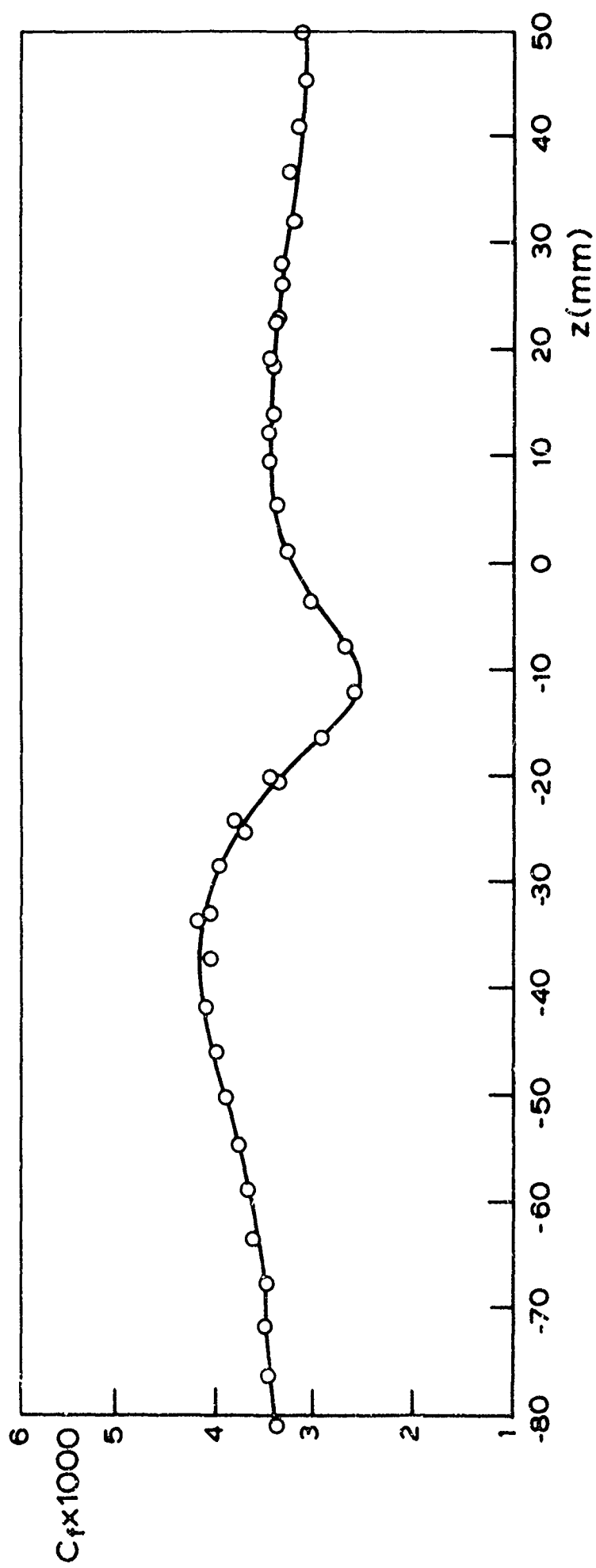


Fig. 8(b) Skin friction coefficient at Station 9 ( $x=1331.6$  mm)

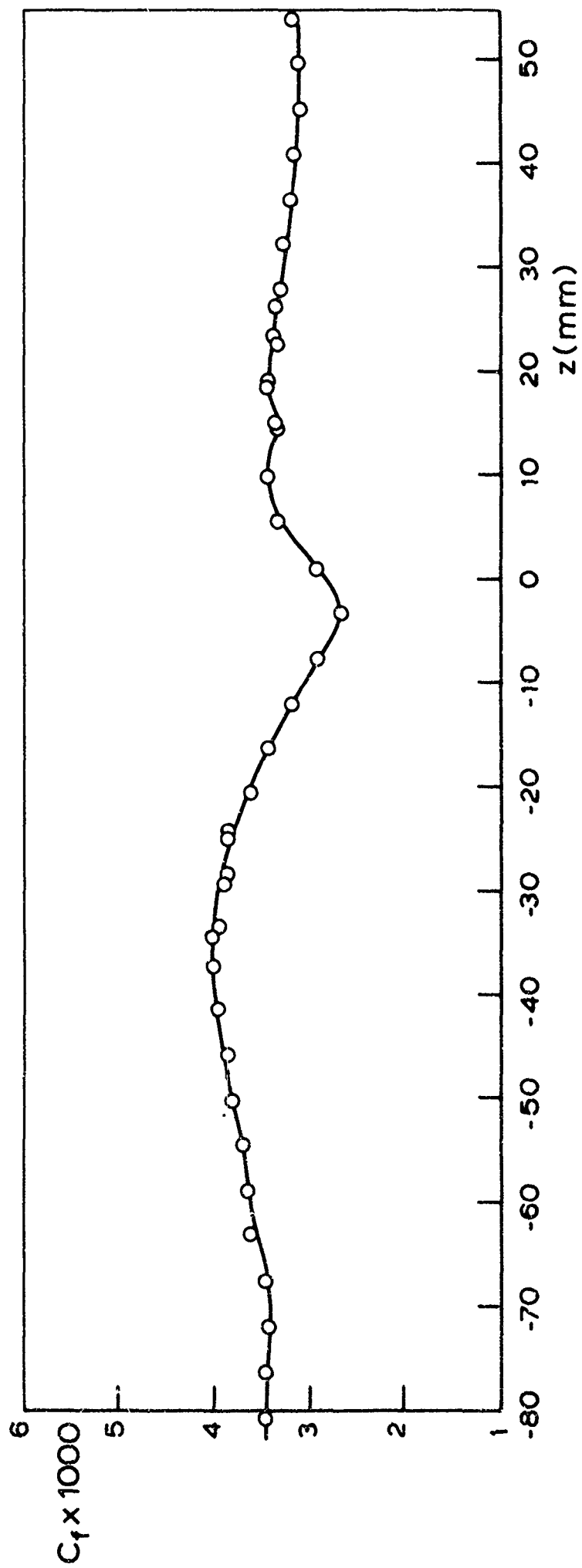


Fig. 8(c) Skin friction coefficient at Station 13 ( $x=1941.2$  mm)

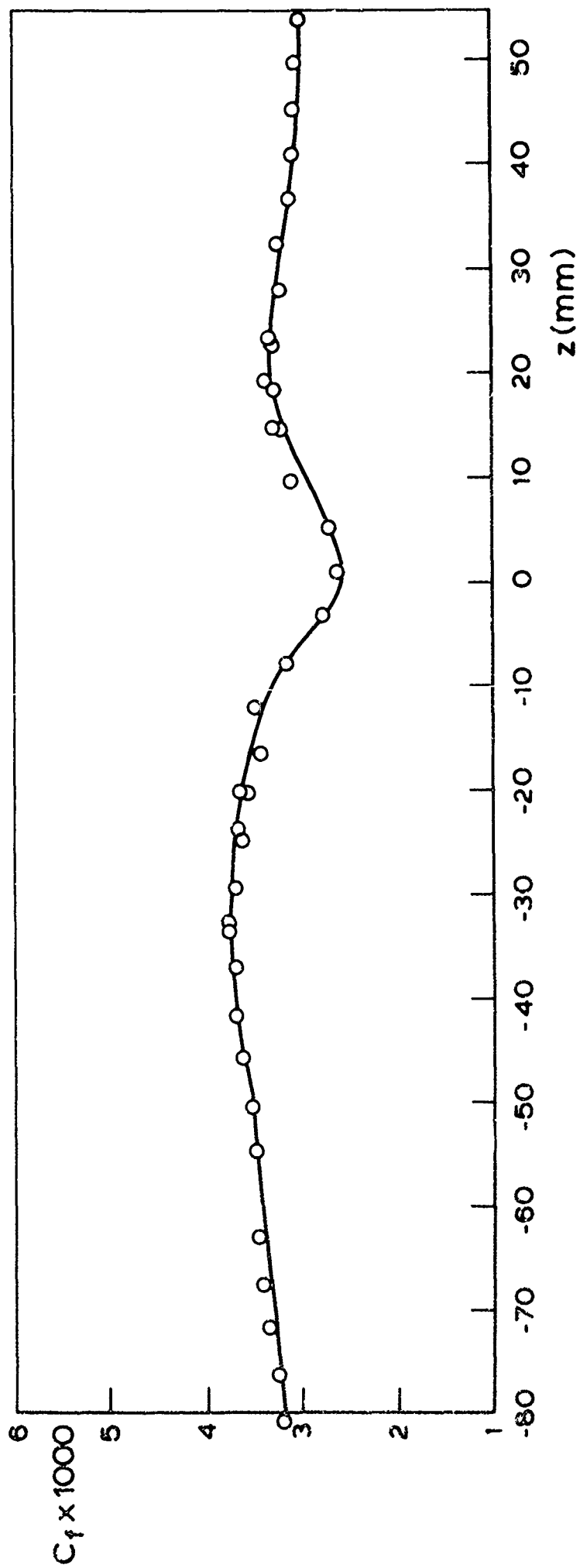
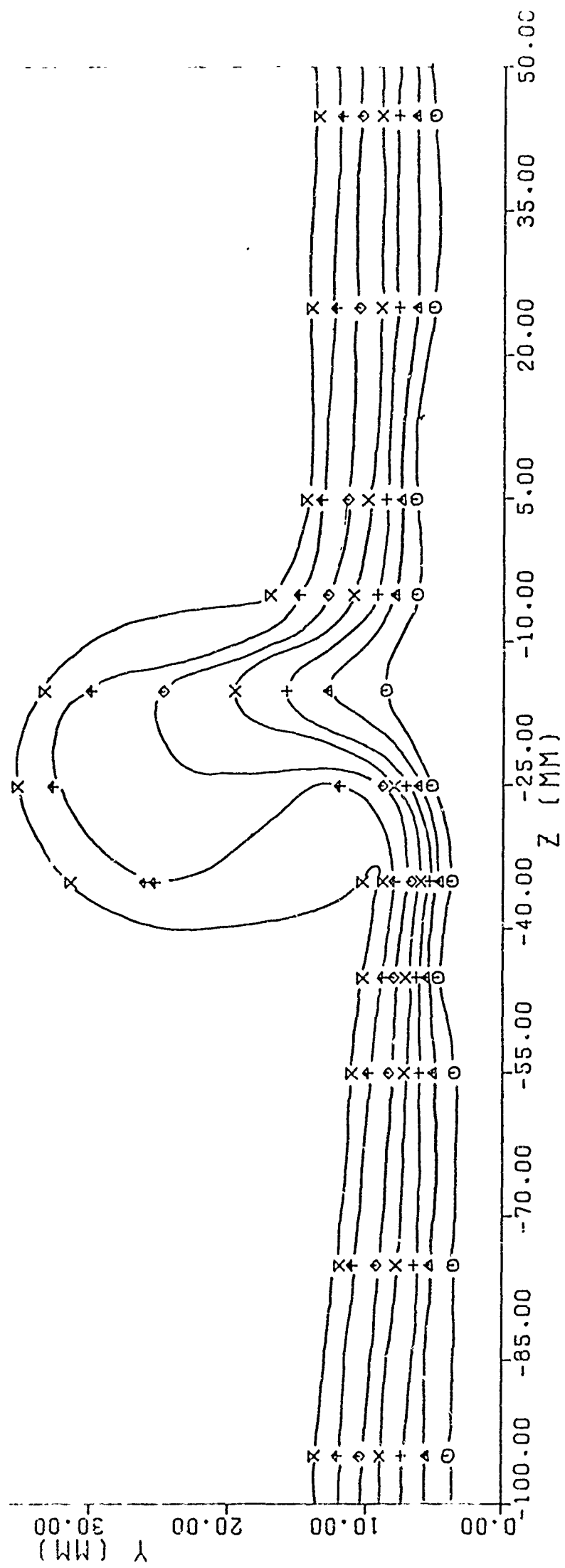


Fig. 8(d) Skin friction coefficient at Station 17 ( $x=2550.8$  mm)

Fig. 9 Contours of  $\bar{u}_i \bar{u}_j / U_e^2$ : Single vortex  $x=722$  mm

Fig. 9(a)  $\bar{u}^2$

$\ominus$	$USQ = .006$	$\diamond$	$USQ = .002$
$\Delta$	$USQ = .005$	$\uparrow$	$USQ = .001$
$+$	$USQ = .004$	$\times$	$USQ = .0005$
$\times$	$USQ = .003$		



60.00

50.00

40.00

30.00

20.00

10.00

0.00

Fig. 9(b)  $\overline{v^2}$ 

○	$\overline{v^2} = .0016$	◇	$\overline{v^2} = .0008$
△	$\overline{v^2} = .0014$	↑	$\overline{v^2} = .00069$
+	$\overline{v^2} = .0012$	×	$\overline{v^2} = .0004$
×	$\overline{v^2} = .0010$	Z	$\overline{v^2} = .0002$

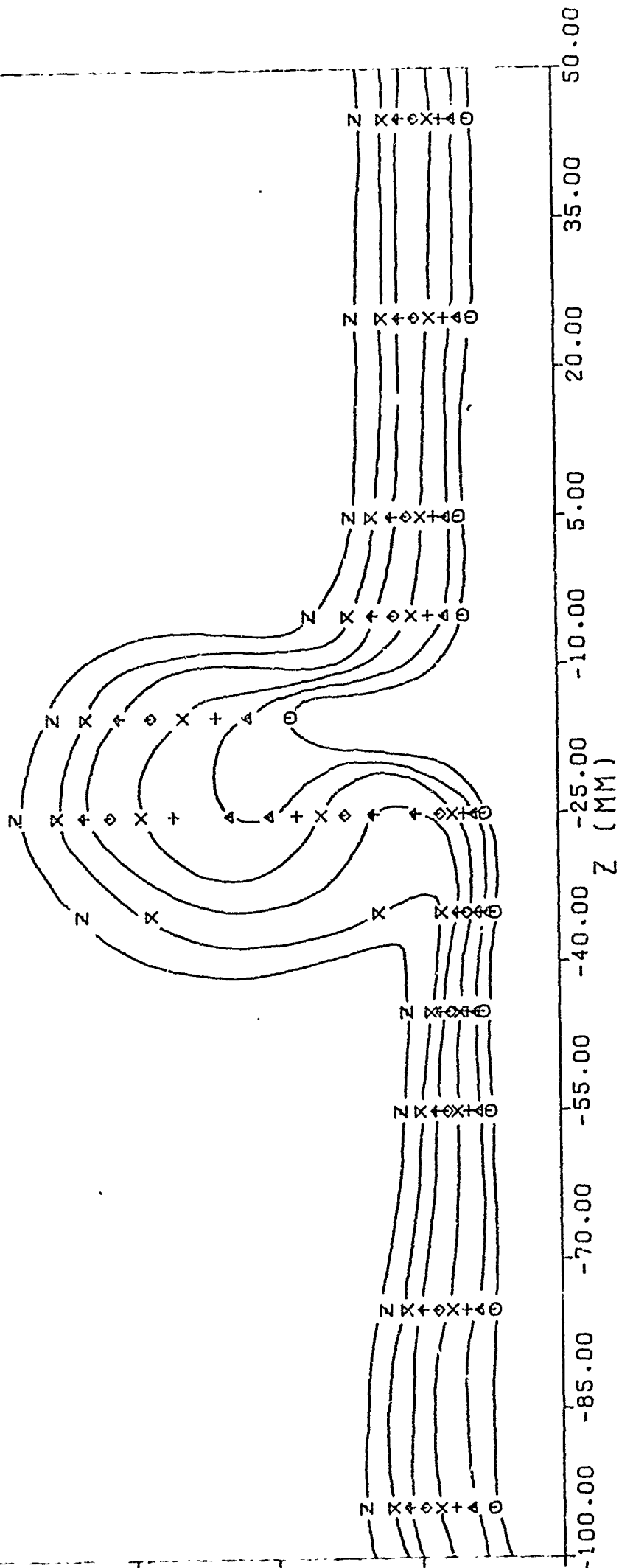


Fig. 9(c)

⊙	WSQ = .0027	4	WSQ = .0012
△	WSQ = .0024	X	WSQ = .0009
+	WSQ = .0021	Z	WSQ = .0006
X	WSQ = .0018	Y	WSQ = .0003
◇	WSQ = .0015		

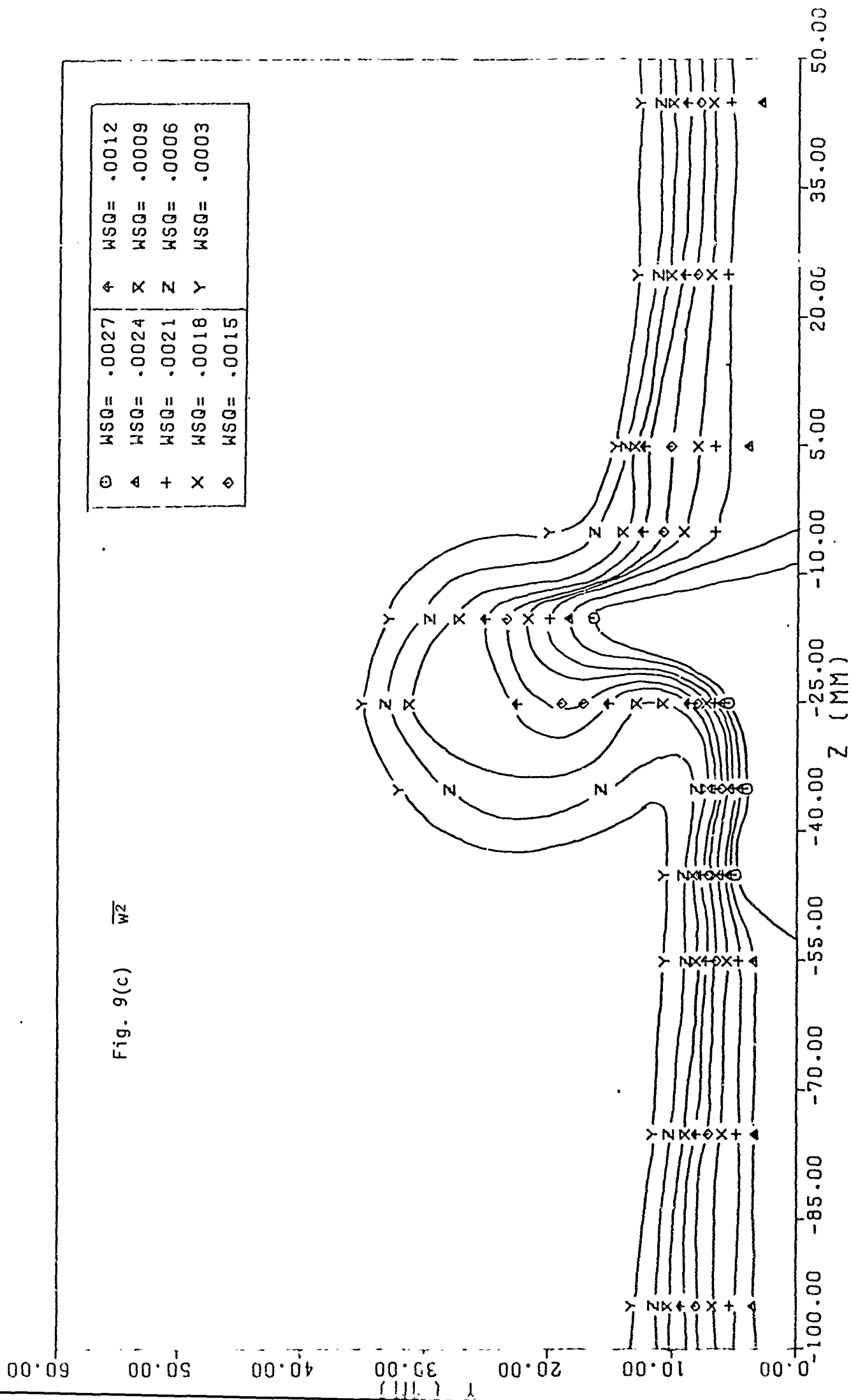
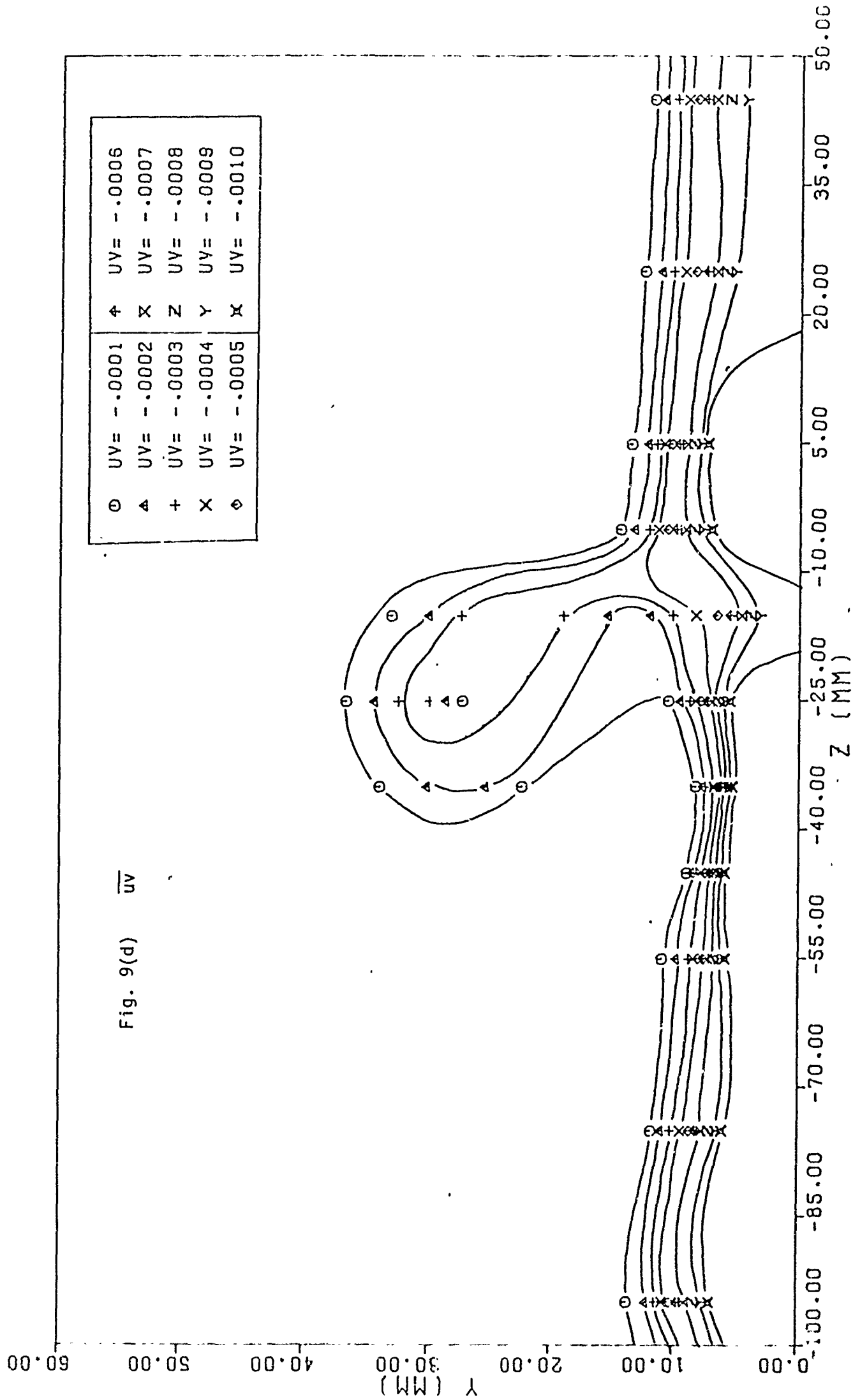
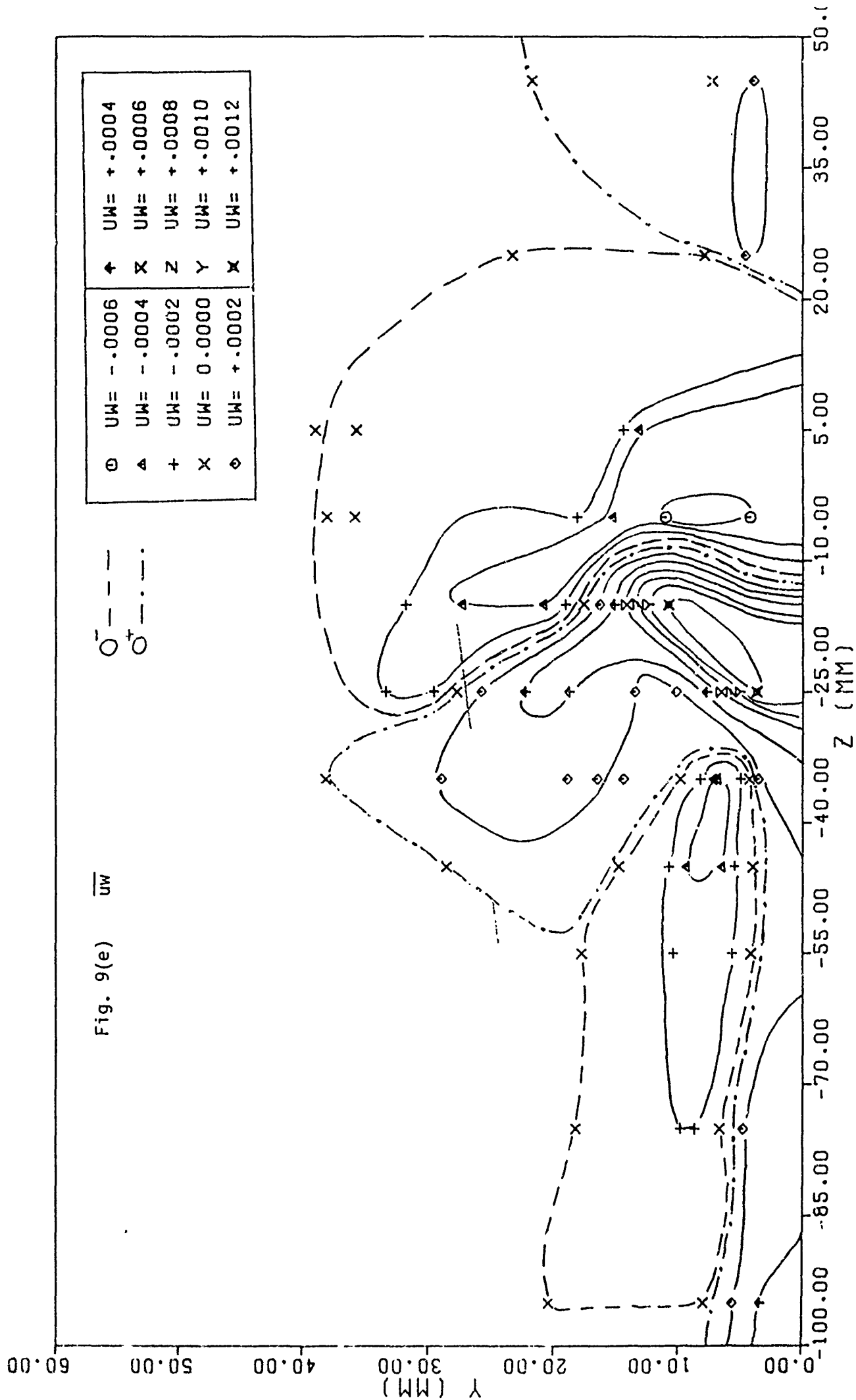


Fig. 9(d)  $\overline{uv}$







60.00

50.00

40.00

30.00

20.00

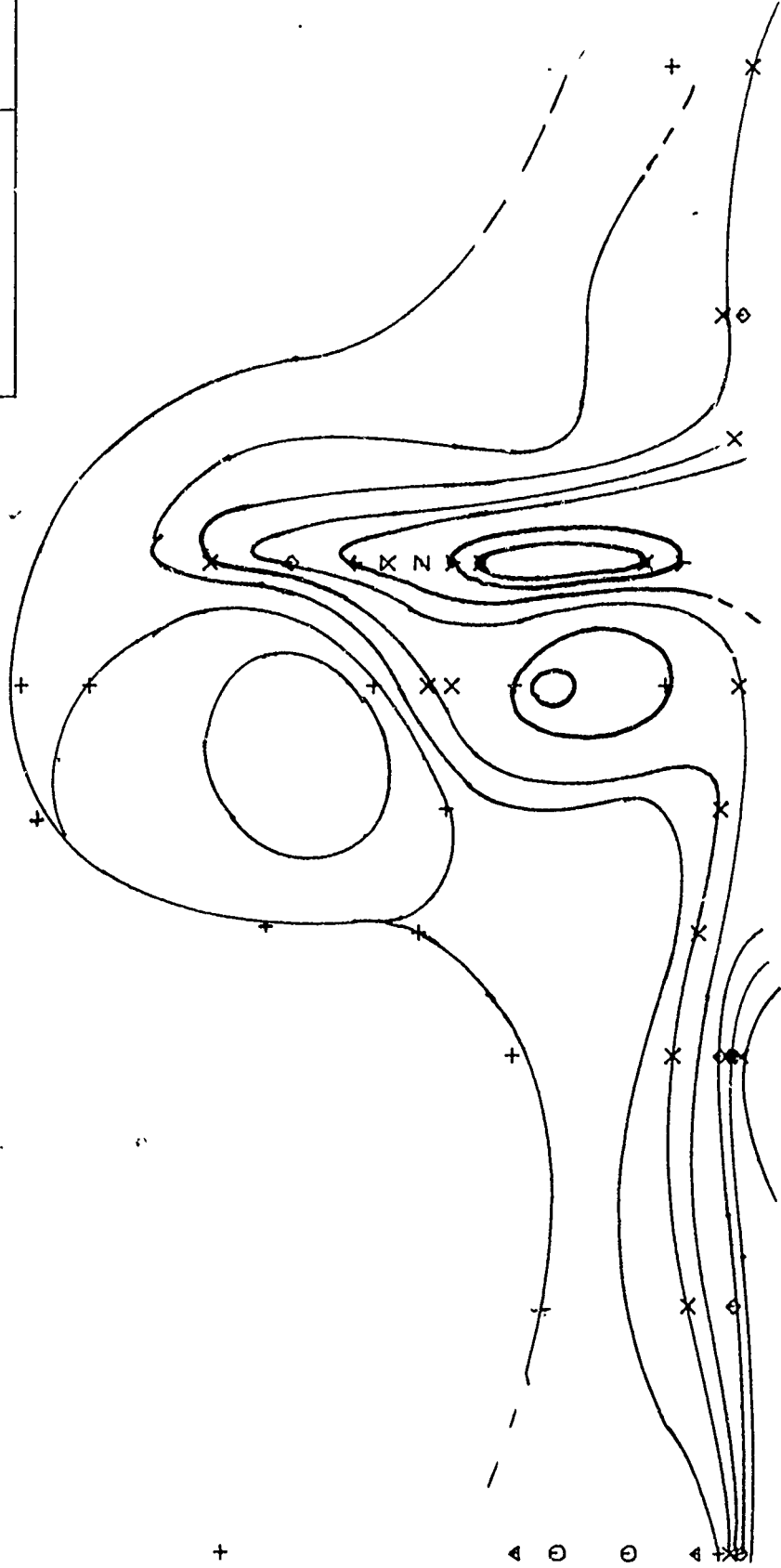
10.00

0.00

Y (MM)

Fig. 9(f)  $\overline{vw}$

⊖	VW = - .0002	⊕	VW = + .0003
△	VW = - .0001	⊗	VW = + .0004
+	VW = 0.0	⊙	VW = + .0005
×	VW = + .0001	⊖	VW = + .0006
◇	VW = + .0002	⊗	VW = + .0007



Z (MM)

-10.00

5.00

20.00

35.00

50.00

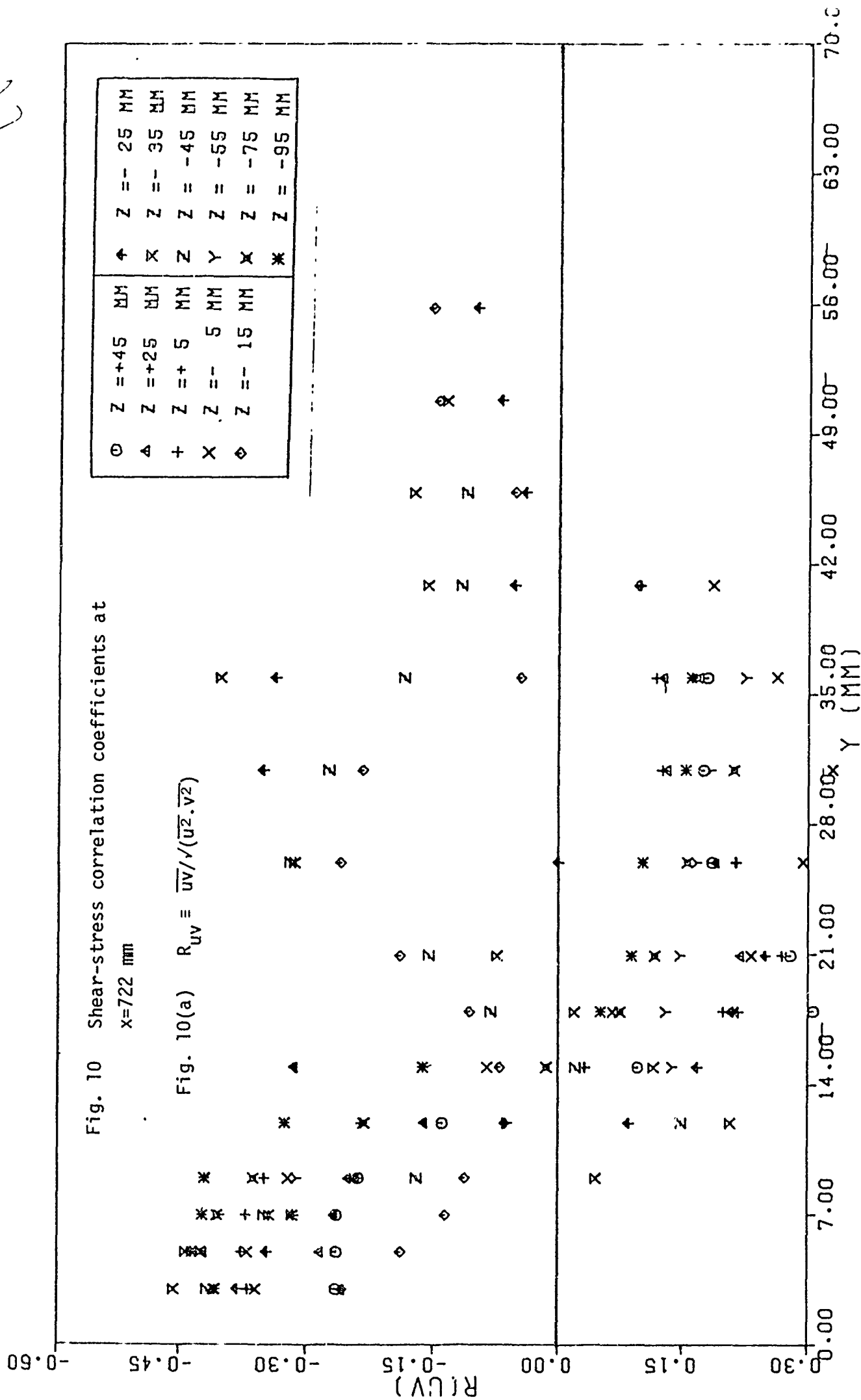
12

Fig. 10 Shear-stress correlation coefficients at

x=722 mm

Fig. 10(a)  $R_{uv} \equiv \overline{uv} / \sqrt{(\overline{u^2} \cdot \overline{v^2})}$

○	Z = +45	MM	↑	Z = -25	MM
△	Z = +25	MM	×	Z = -35	MM
+	Z = +5	MM	Z	Z = -45	MM
×	Z = -5	MM	Y	Z = -55	MM
◇	Z = -15	MM	×	Z = -75	MM
			*	Z = -95	MM



Δ

⊙

Fig. 10(b)  $R_{uw} \equiv \overline{uw} / \sqrt{(u^2 + w^2)}$

0.60  
0.40  
0.20  
0.00  
-0.20  
-0.40  
-0.60

R (UM)

0.00

7.00

14.00

21.00

28.00

35.00

42.00

49.00

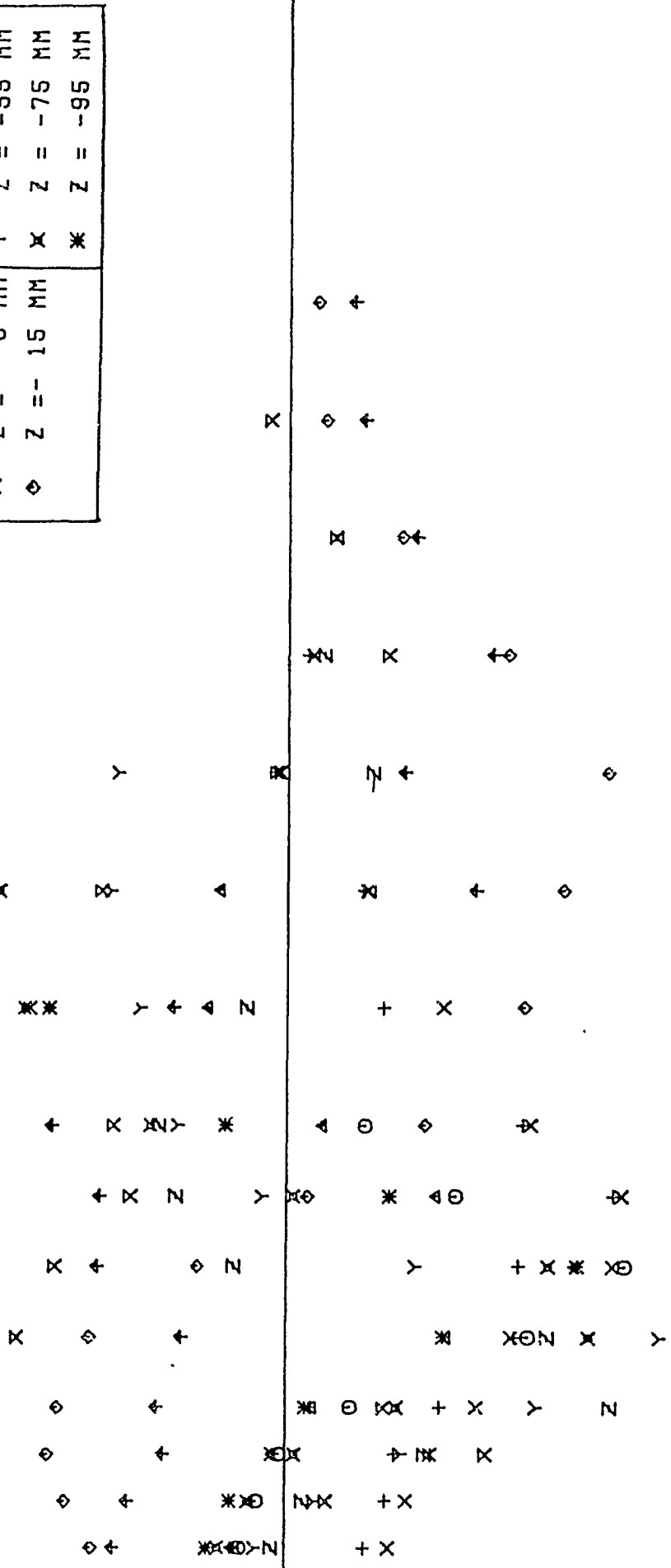
56.00

63.00

70.00

Y (MM)

⊙	Z = +45	MM	↑	Z = -25	MM
Δ	Z = +25	MM	×	Z = -35	MM
+	Z = +5	MM	Z	Z = -45	MM
×	Z = -5	MM	Y	Z = -55	MM
◇	Z = -15	MM	×	Z = -75	MM
			*	Z = -95	MM



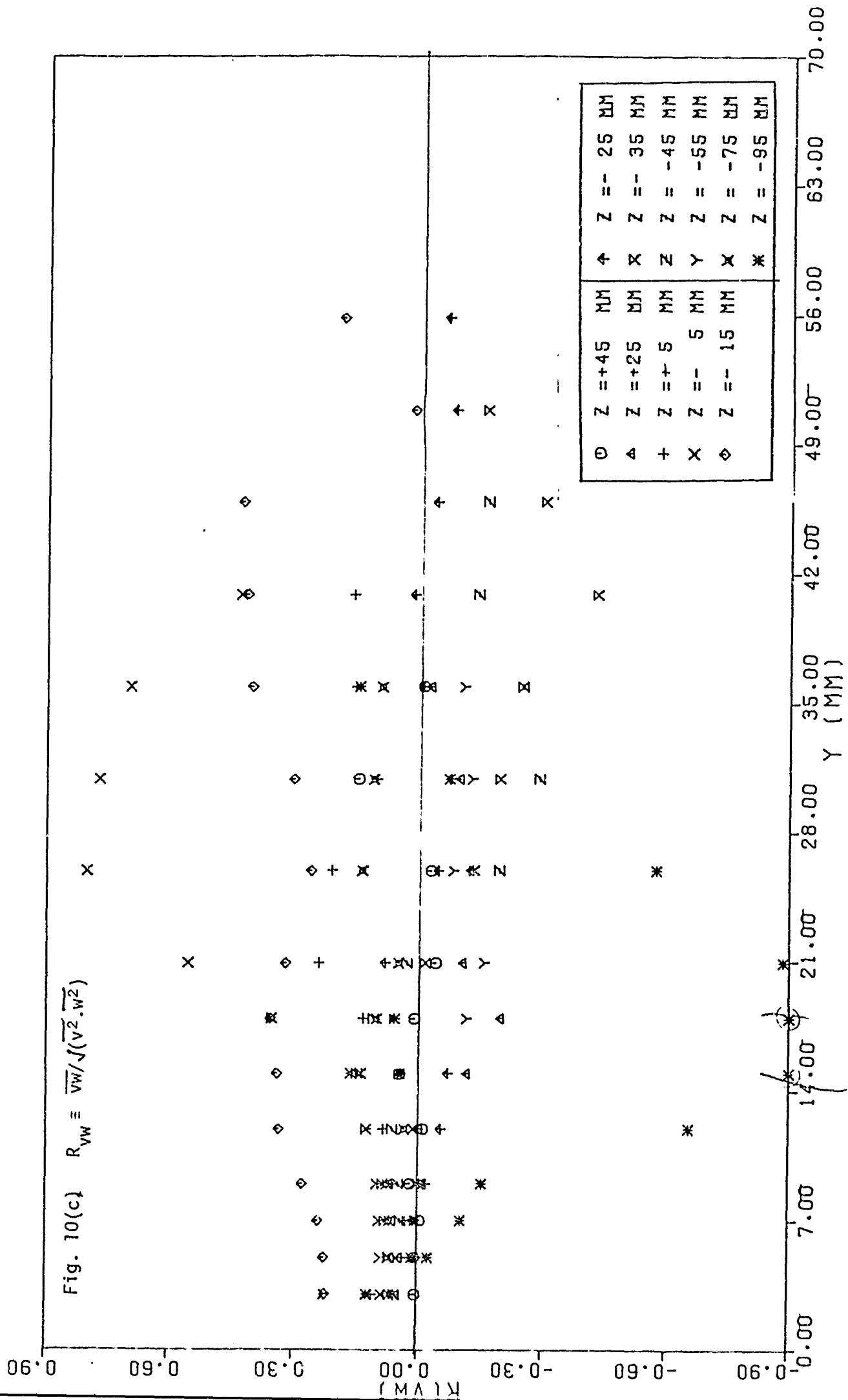
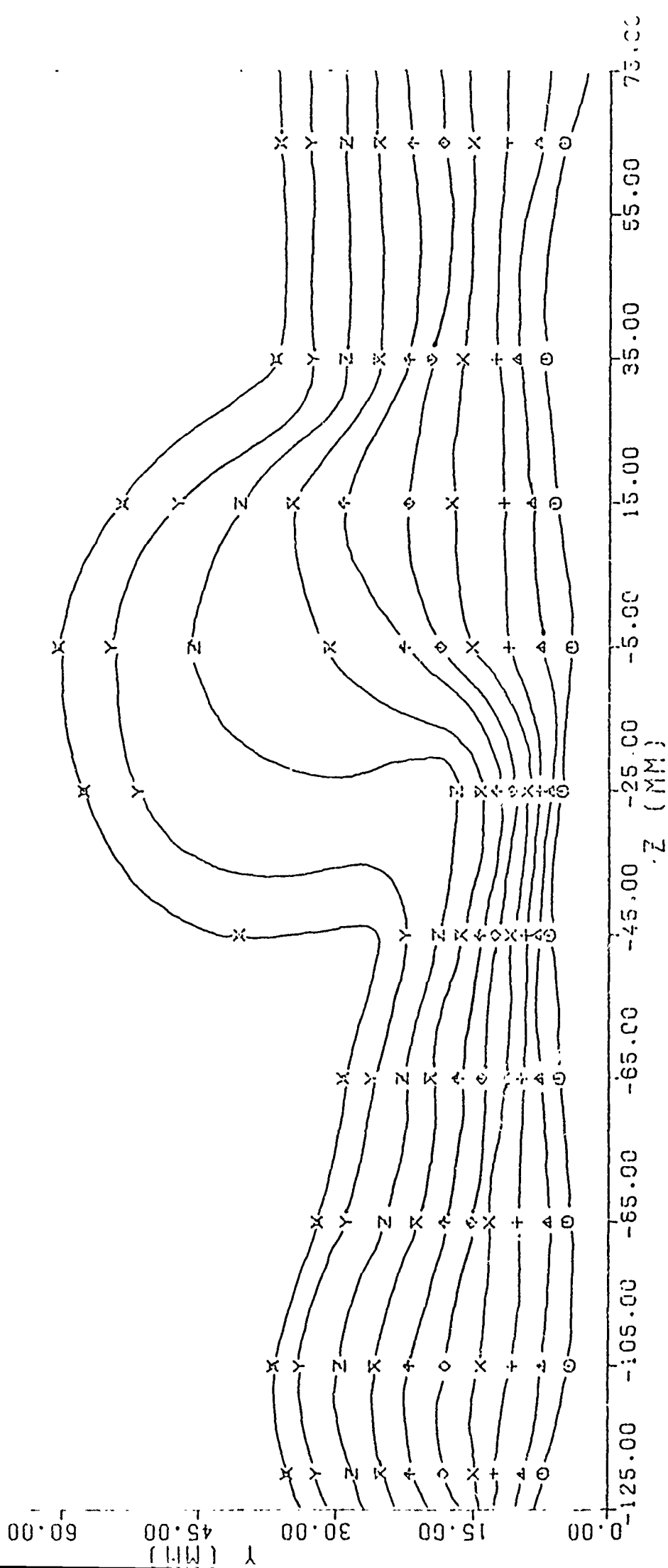


Fig.11 Contours of  $\overline{u_i u_j} / U_e^2$ ,  $x=2551$  mm

Fig. 11 (a)  $\overline{u^2}$

○	USQ = .009	+	USQ = .004
△	USQ = .008	×	USQ = .003
+	USQ = .007	Z	USQ = .002
×	USQ = .006	Y	USQ = .001
◇	USQ = .005	X	USQ = .0005



90.00

75.00

60.00

45.00

30.00

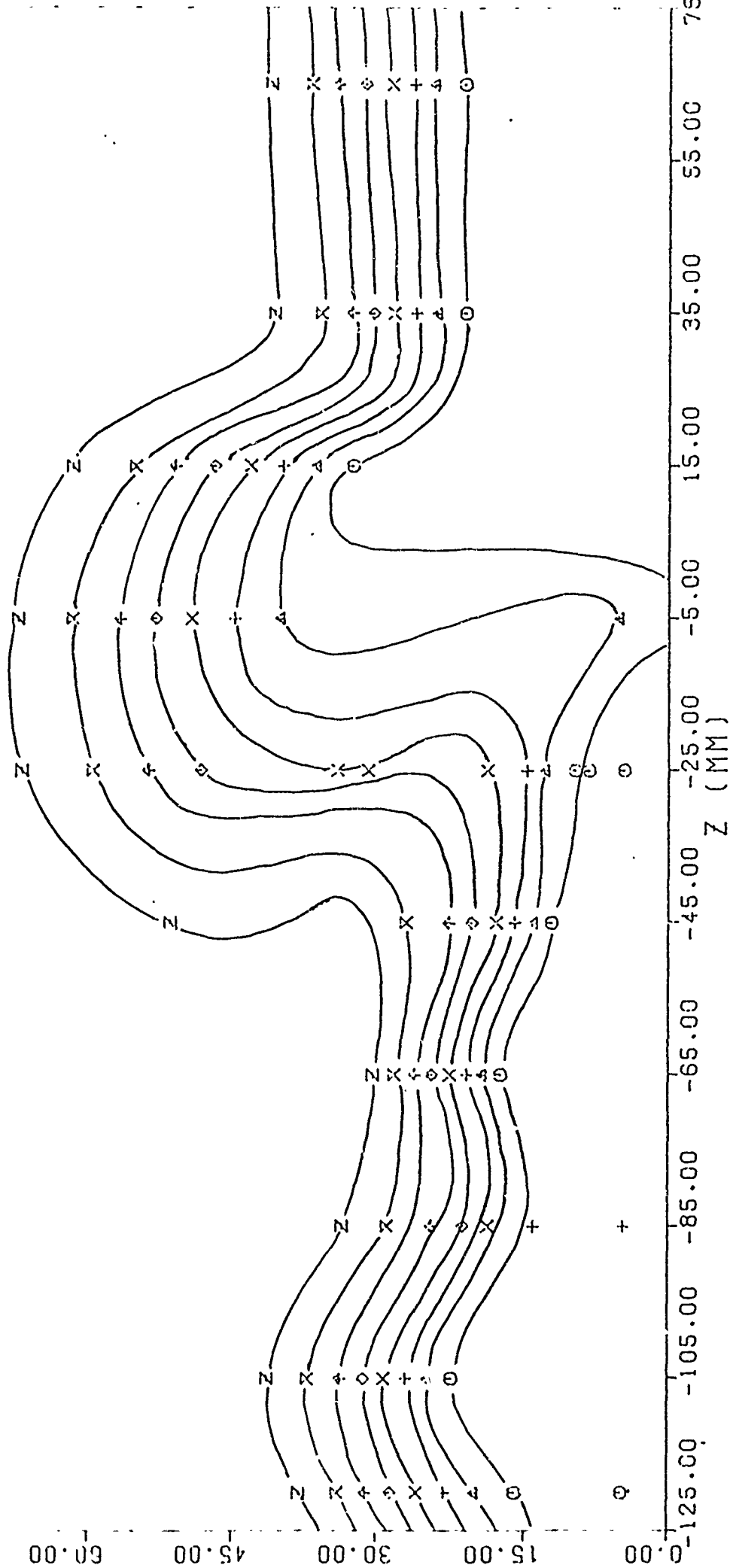
15.00

0.00

Y (MM)

⊖	VSQ= .0016	⊕	VSQ= .0006
△	VSQ= .0014	↑	VSQ= .0006
+	VSQ= .0012	×	VSQ= .0004
×	VSQ= .0010	Z	VSQ= .0002

Fig. 11(b)  $VZ$



-125.00

-105.00

-85.00

-65.00

-45.00

-25.00

-5.00

15.00

35.00

55.00

75.00

Z (MM)

0	WSQ= .0027	+	WSQ= .0012
4	WSQ= .0024	X	WSQ= .0009
+	WSQ= .0021	Z	WSQ= .0006
X	WSQ= .0018	Y	WSQ= .0003
◇	WSQ= .0015		

Fig. 11(c)  $\overline{w^2}$

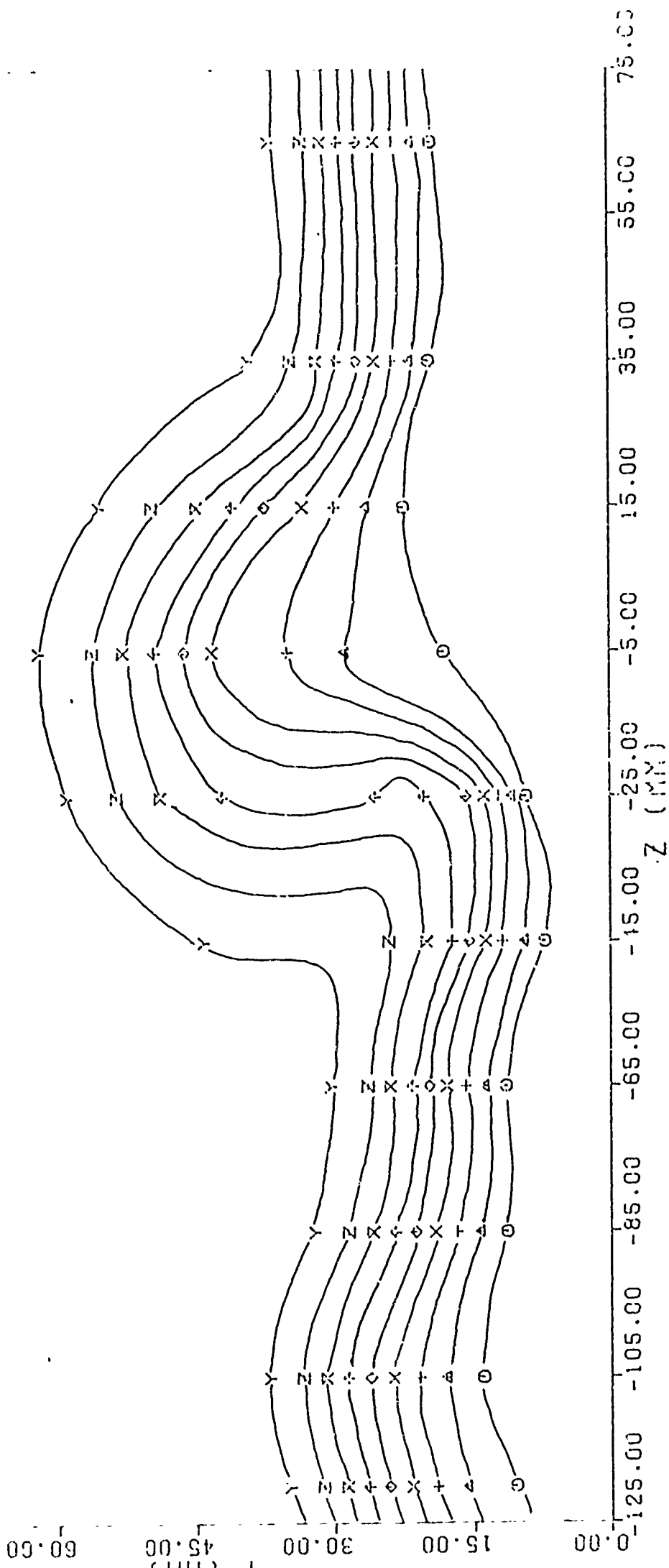
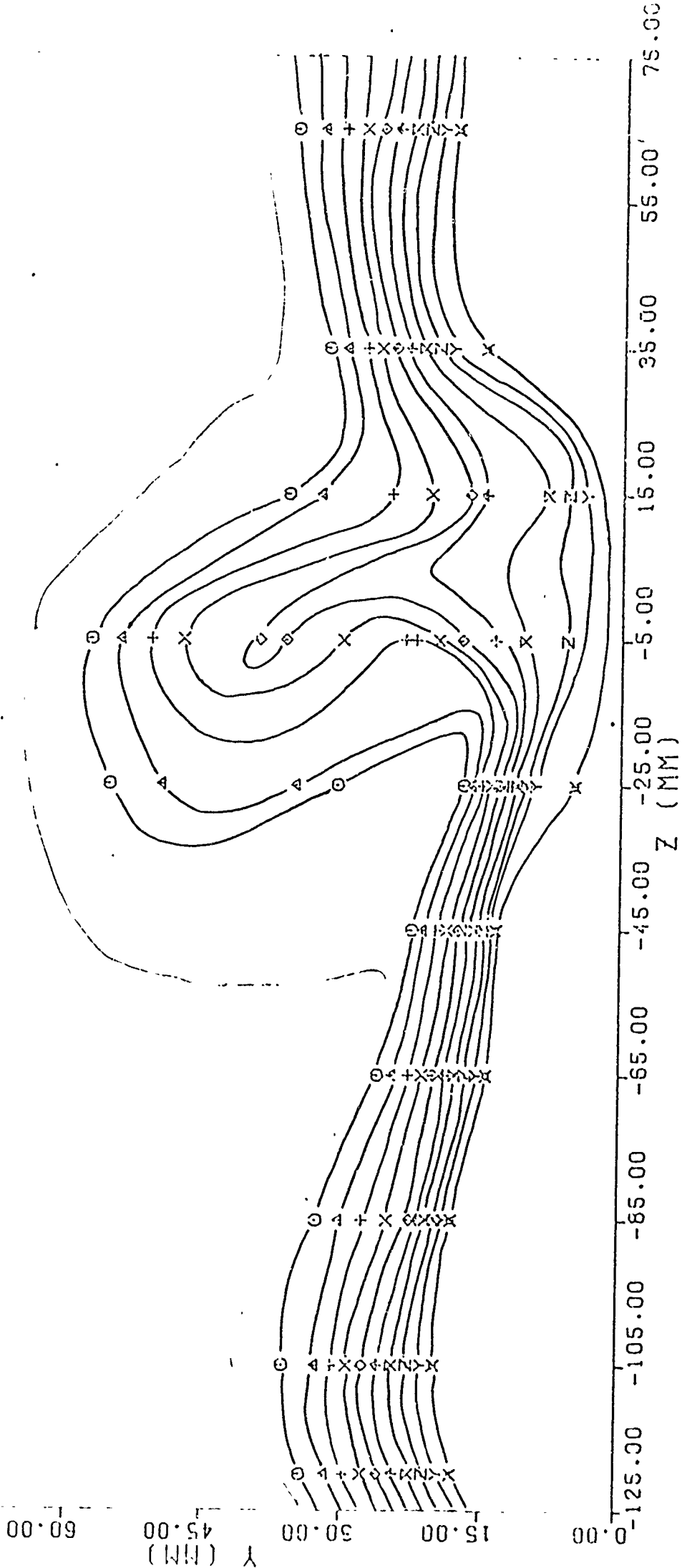


Fig. 11(d)  $\overline{uv}$

$\ominus$	$uv = -.0001$	$+$	$uv = -.0005$
$\Delta$	$uv = -.0002$	$\times$	$uv = -.0007$
$+$	$uv = -.0003$	$z$	$uv = -.0008$
$\times$	$uv = -.0004$	$y$	$uv = -.0009$
$\diamond$	$uv = -.0005$	$\times$	$uv = -.0010$





90.00

75.00

60.00

Y (MM)

45.00

30.00

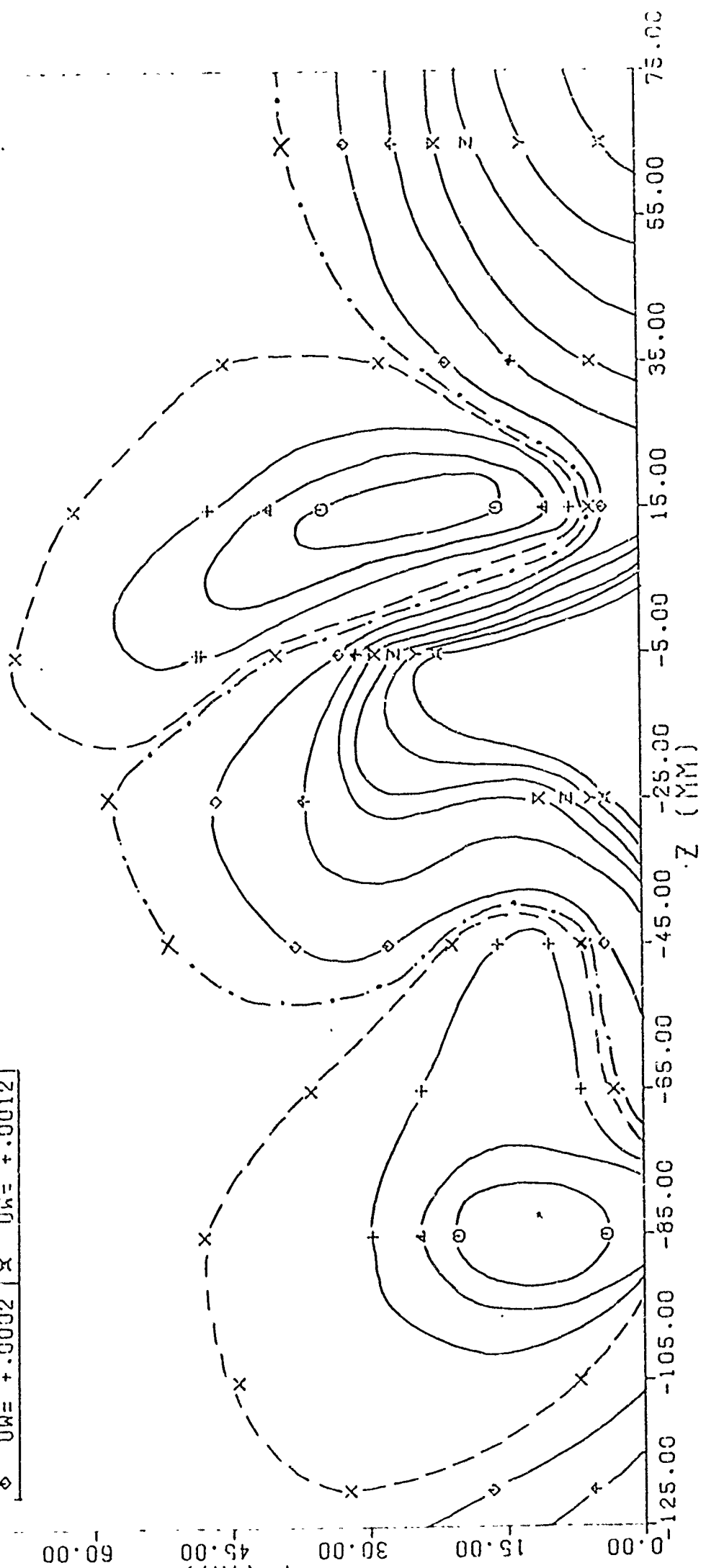
15.00

0.00

Fig. 11(e)  $\overline{uw}$

$\ominus$	$UW = -.0006$	$\oplus$	$UW = +.0004$
$\Delta$	$UW = -.0004$	$\times$	$UW = +.0006$
$+$	$UW = -.0002$	$\nabla$	$UW = +.0008$
$\times$	$UW = 0.0000$	$\gamma$	$UW = +.0010$
$\diamond$	$UW = +.0002$	$\times$	$UW = +.0012$

$\ominus$   
—  
- - -  
 $\oplus$



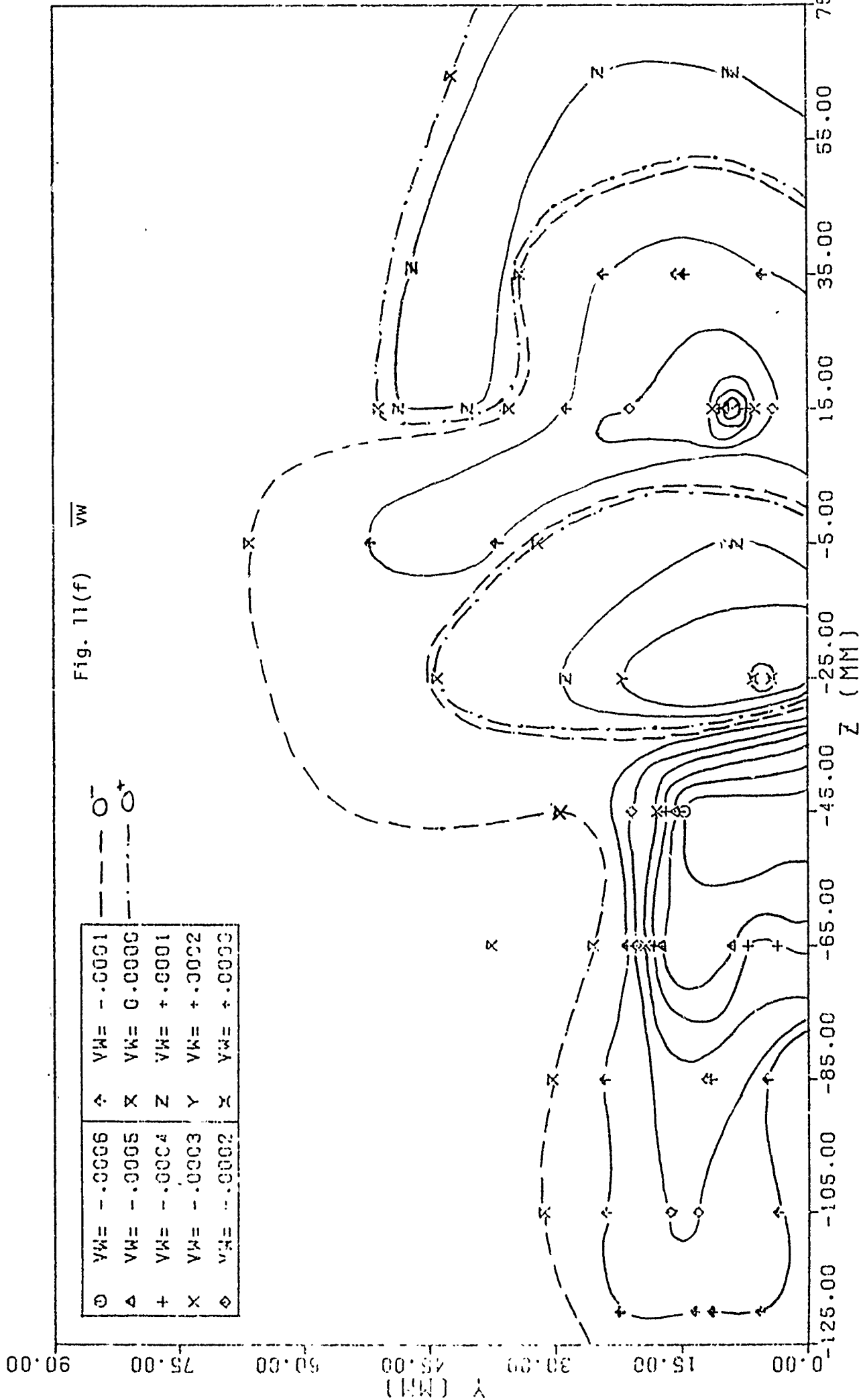


Fig. 12 Shear-stress correlation coefficients at x=2551 mm

0	Z = -120 MM	+	Z = -25 MM
△	Z = -105 MM	X	Z = -5 MM
+	Z = -85 MM	Z	Z = 15 MM
X	Z = -65 MM	Y	Z = 35 MM
◇	Z = -45 MM	X	Z = 65 MM

Fig. 12(a)  $R_{UV}$

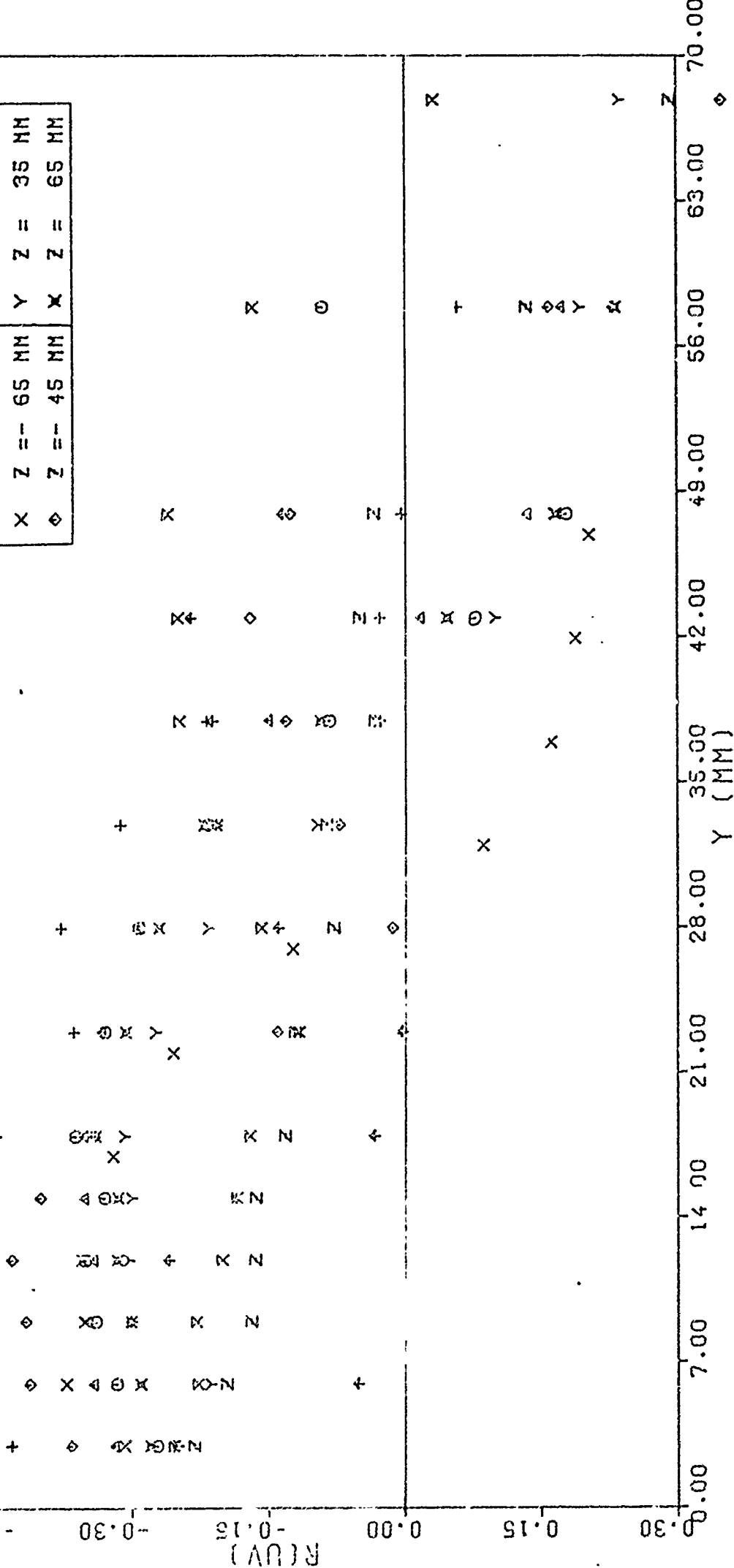
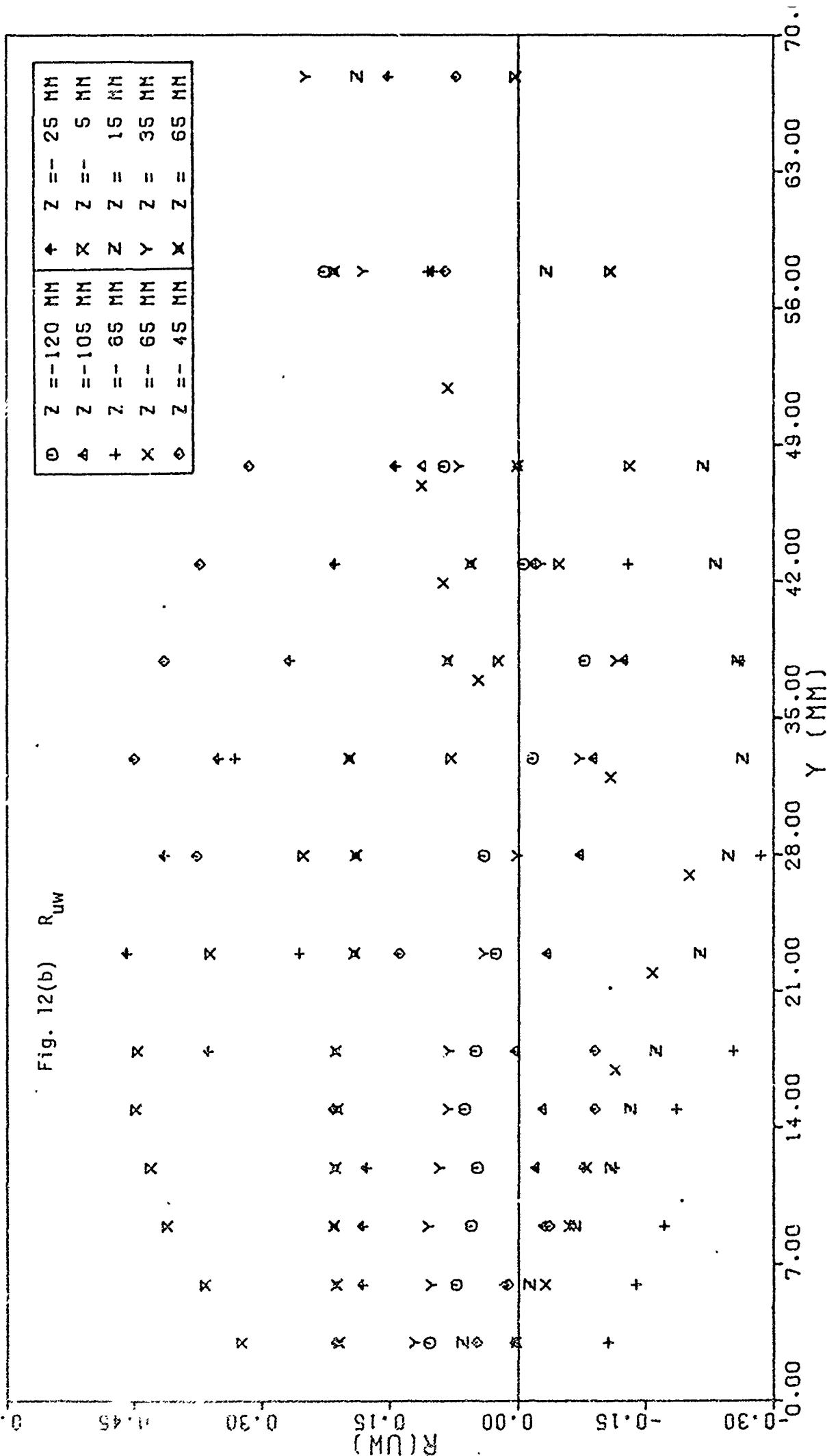
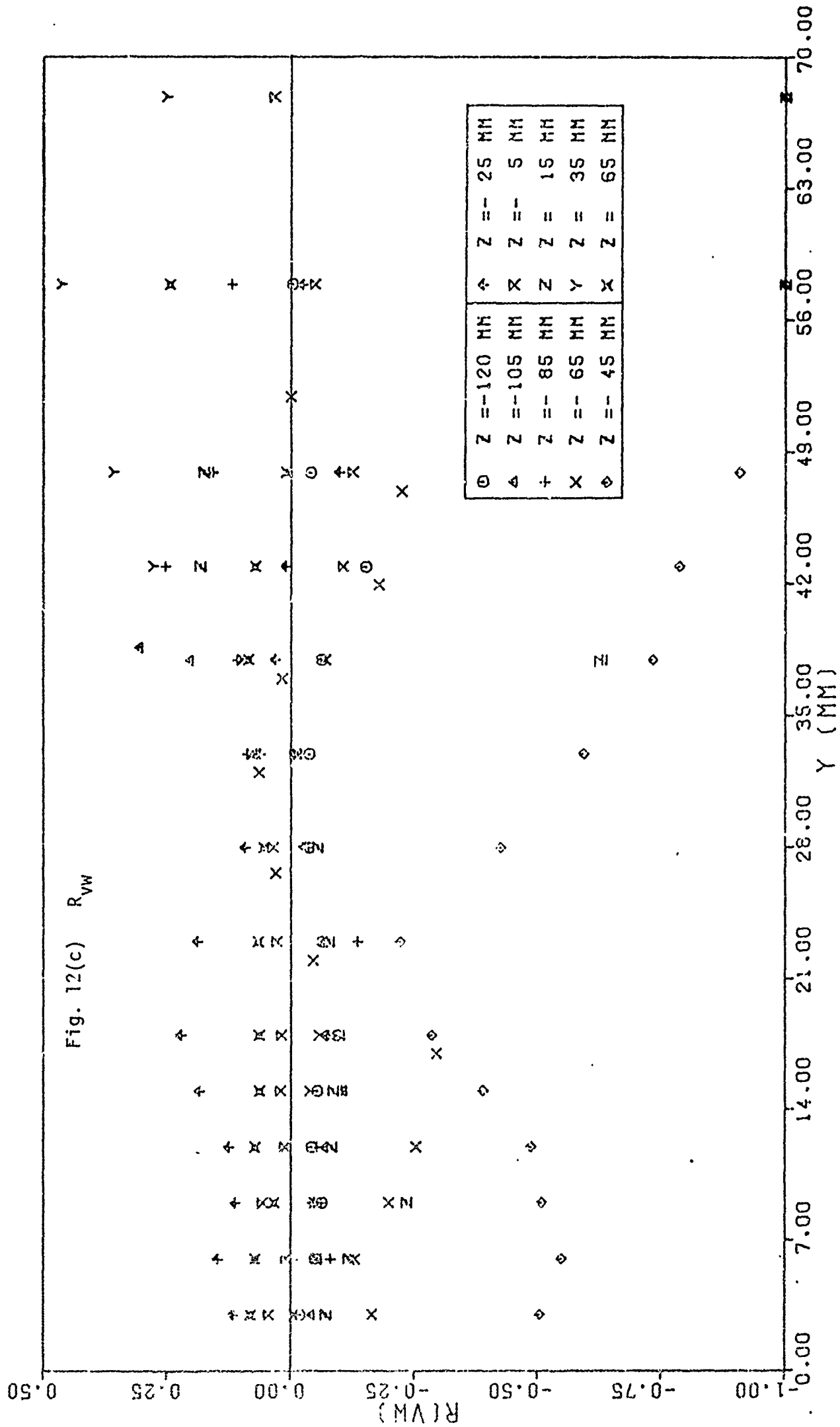


Fig. 12(b)  $R_{uw}$

$\ominus$	Z = -120 MM	$\uparrow$	Z = -25 MM
$\Delta$	Z = -105 MM	$\times$	Z = -5 MM
+	Z = -85 MM	Z	Z = 15 MM
$\times$	Z = -65 MM	Y	Z = 35 MM
$\diamond$	Z = -45 MM	$\times$	Z = 65 MM





90.00

75.00

60.00

45.00

30.00

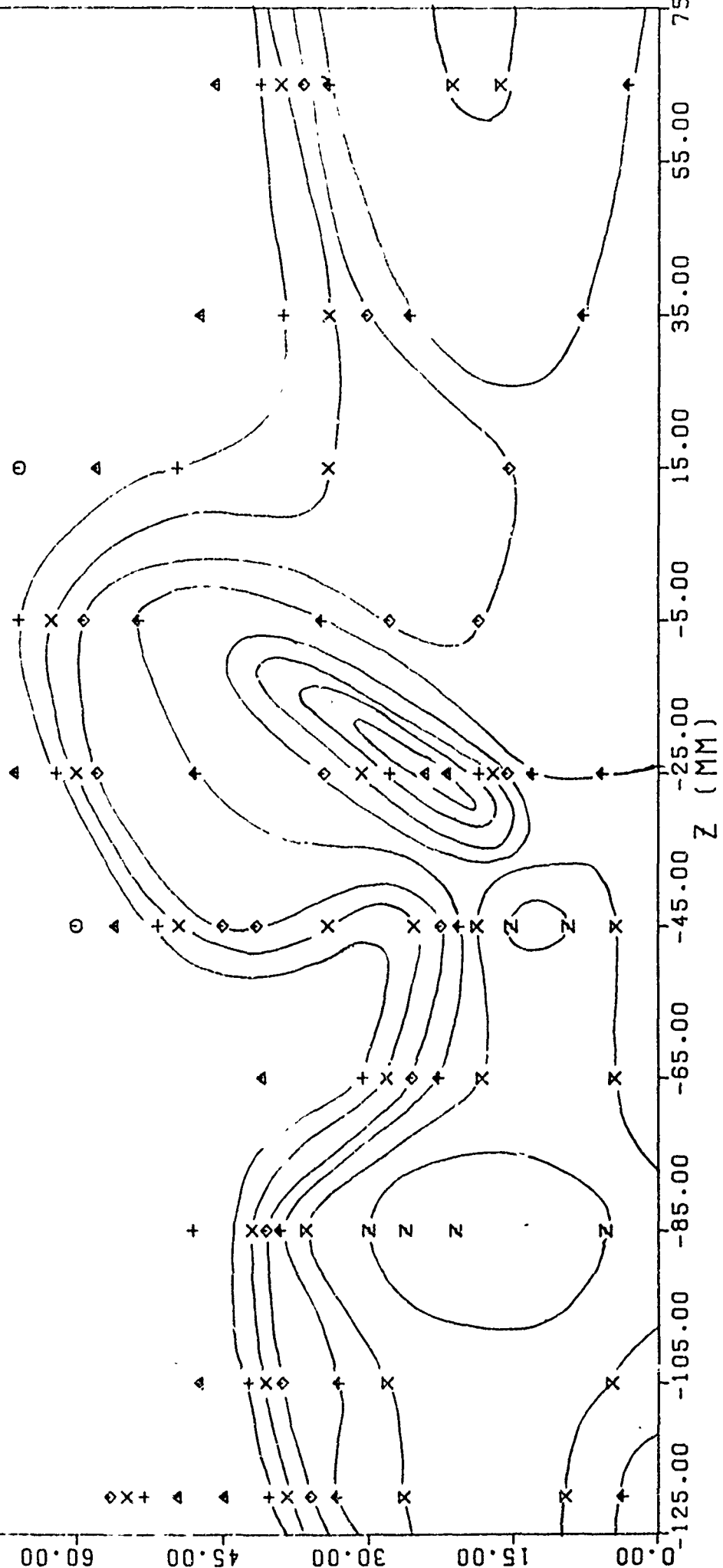
15.00

0.00

Y (MM)

○	R1 = -.10	◇	R1 = .050
△	R1 = -.05	+	R1 = .075
+	R1 = 0.0	X	R1 = .10
X	R1 = .025	Z	R1 = .125

Fig. 12(d)  $a_1 \equiv -\overline{uv}/(\overline{u^2+v^2+w^2})$



0.00

15.00

30.00

45.00

60.00

75.00

90.00

Z (MM)

-125.00

-105.00

-85.00

-65.00

-45.00

-25.00

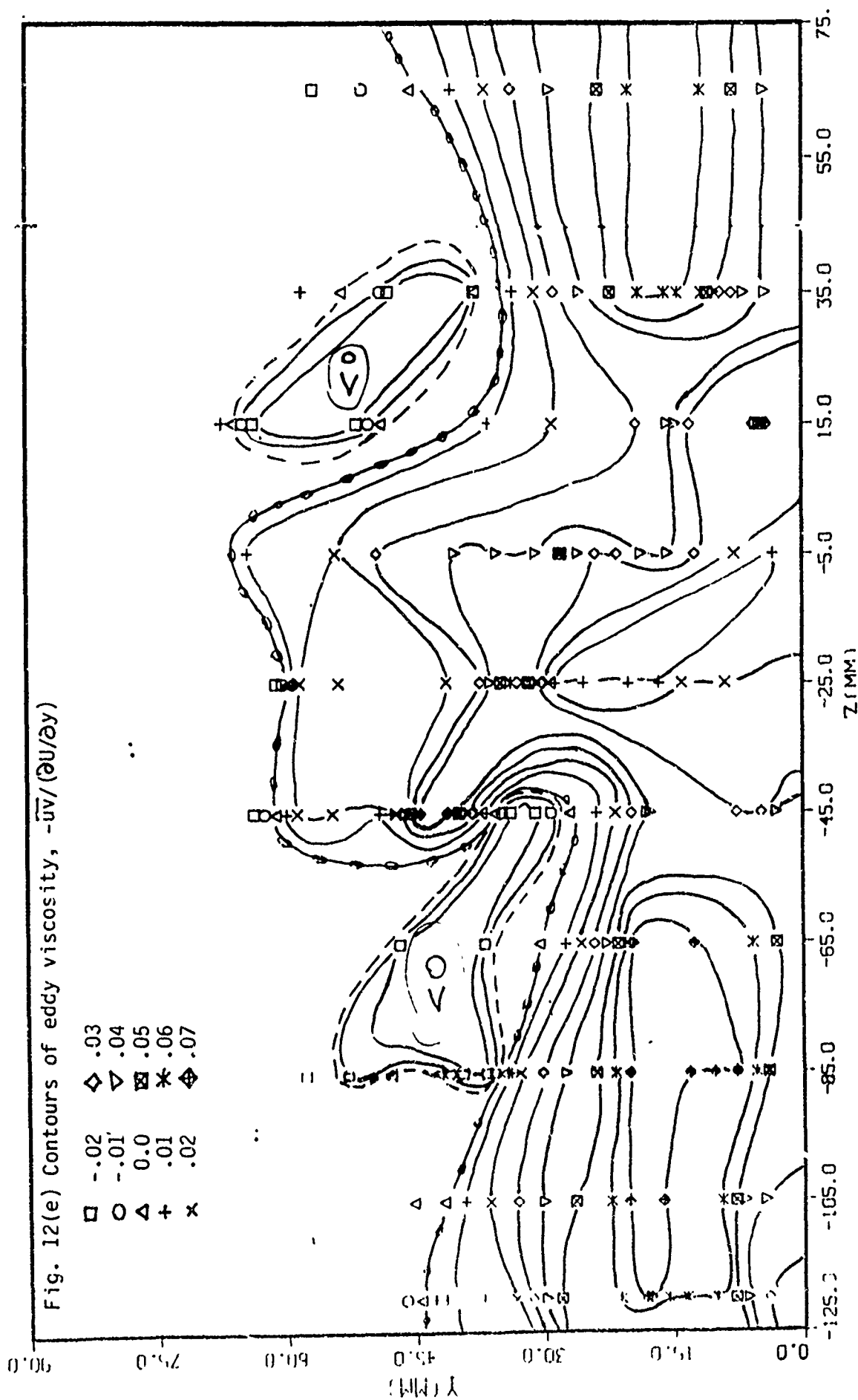
-5.00

15.00

35.00

55.00

75.00



0.21

0.14

0.07

0.00

-0.07

-0.14

-0.21

0.00

7.00

14.00

21.00

28.00

35.00

42.00

49.00

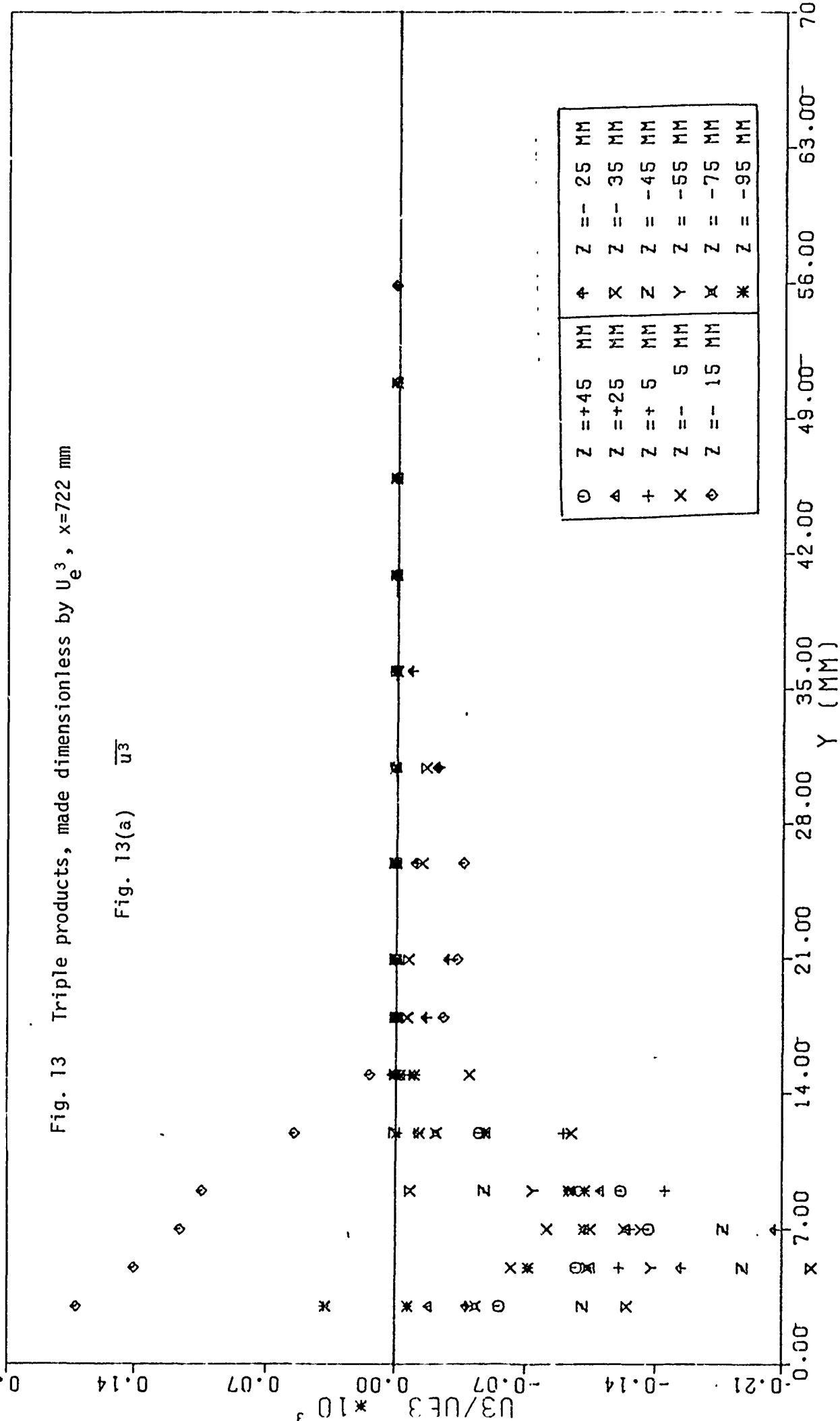
56.00

63.00

70.00

Fig. 13 Triple products, made dimensionless by  $U_e^3$ ,  $x=722$  mm

Fig. 13(a)  $\overline{u^3}$





13

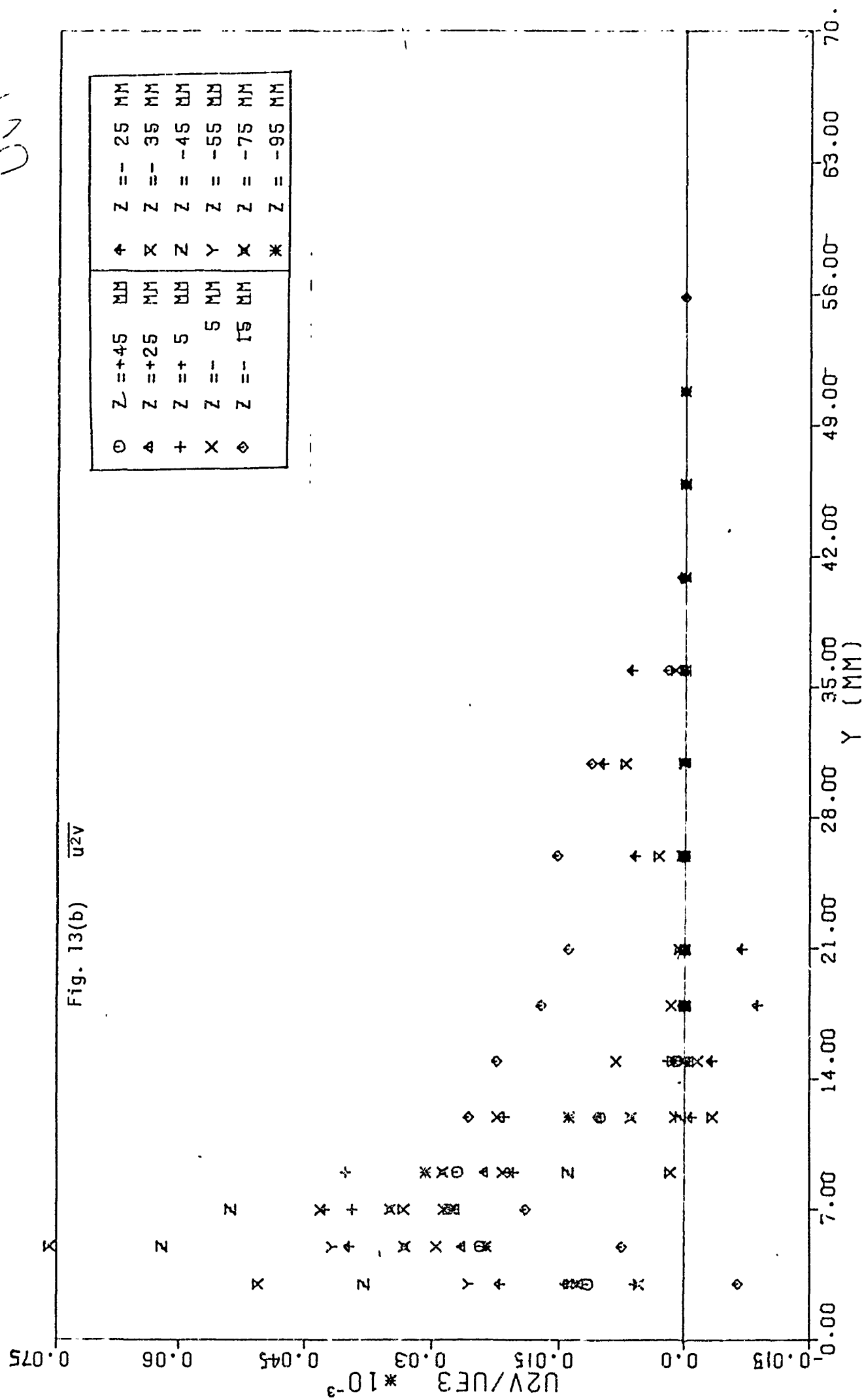


Fig. 13(c)  $\overline{uv^2}$

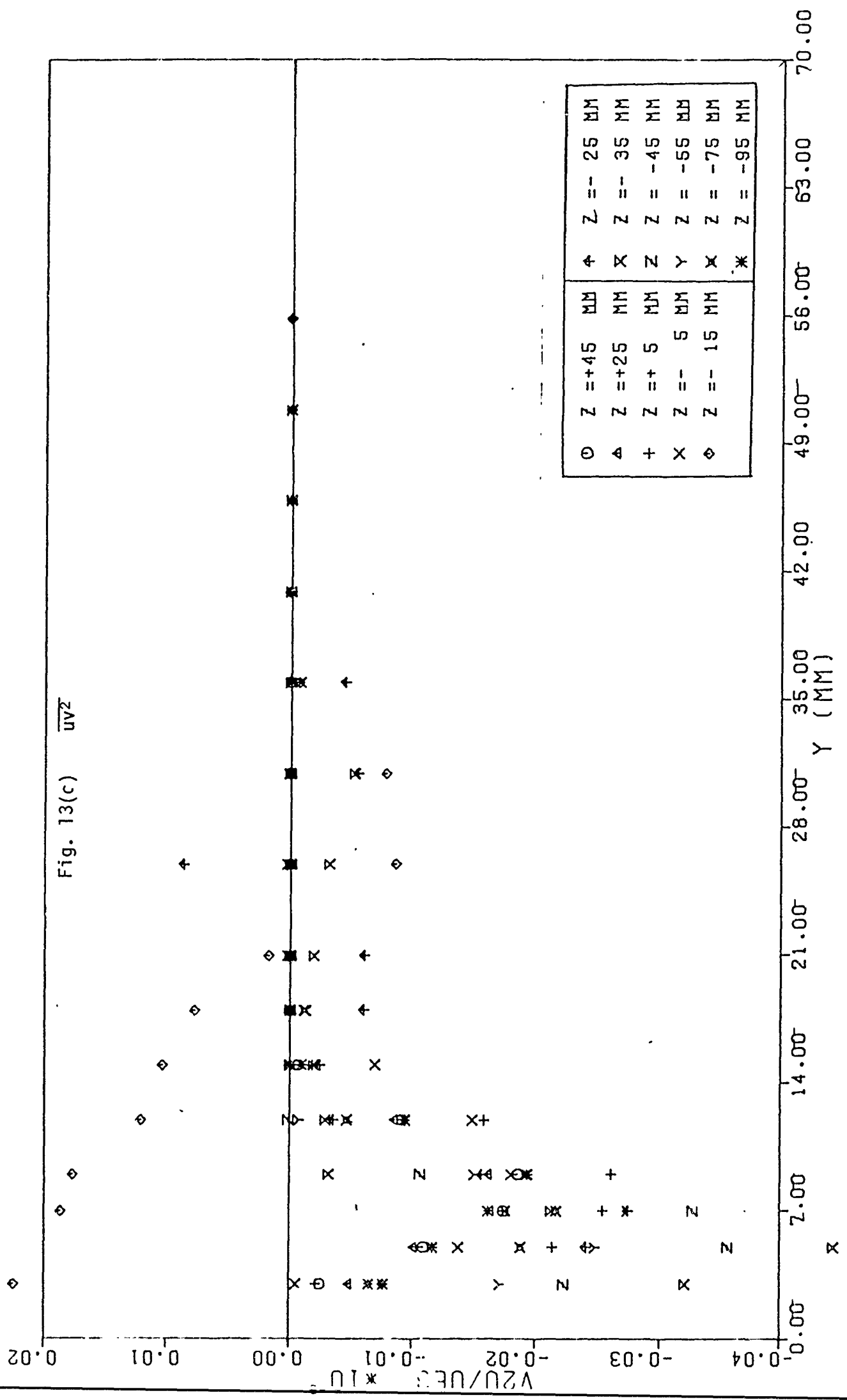


Fig. 13(d)  $\overline{v^3}$

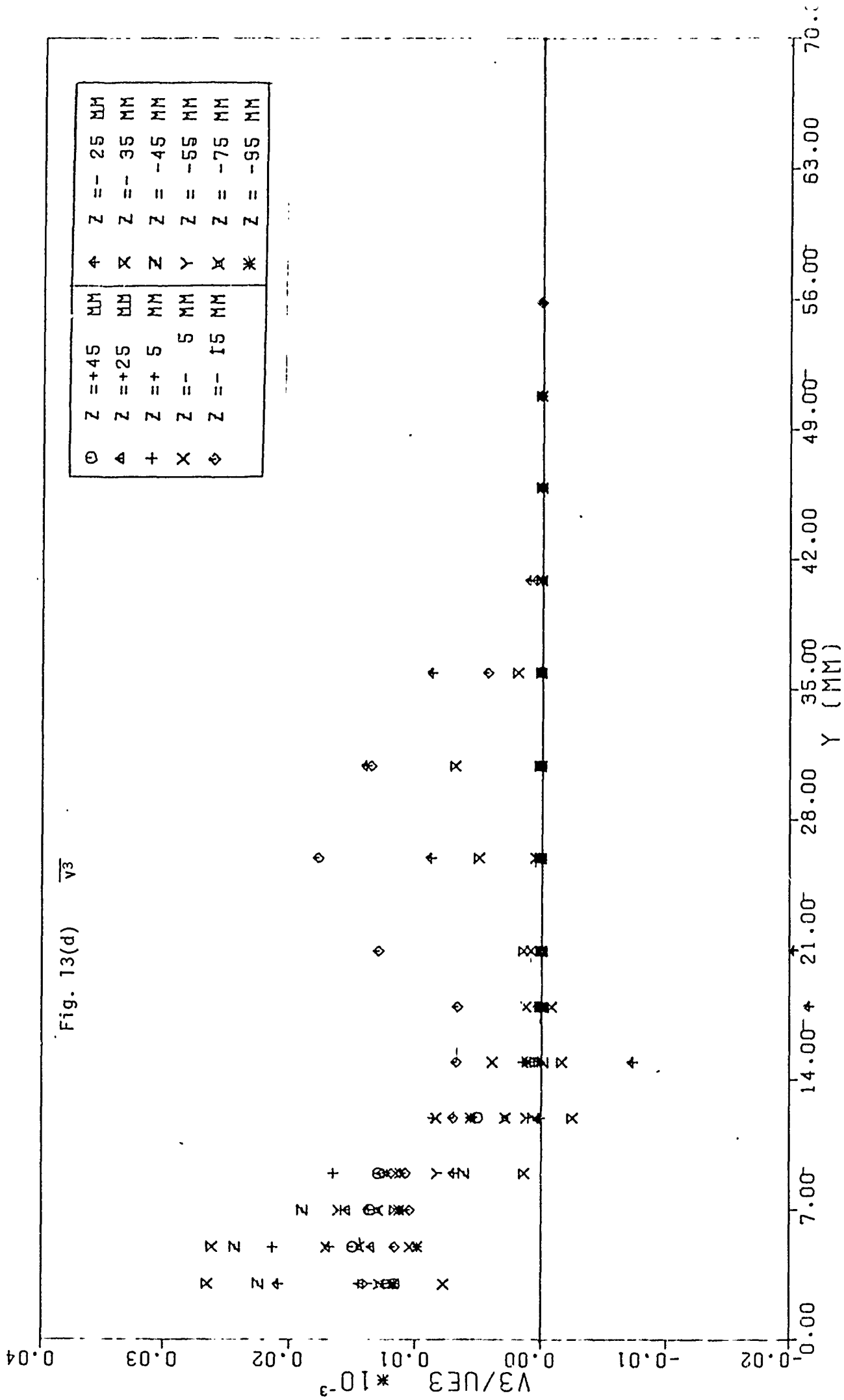


Fig. 13(e)  $\overline{u2w}$

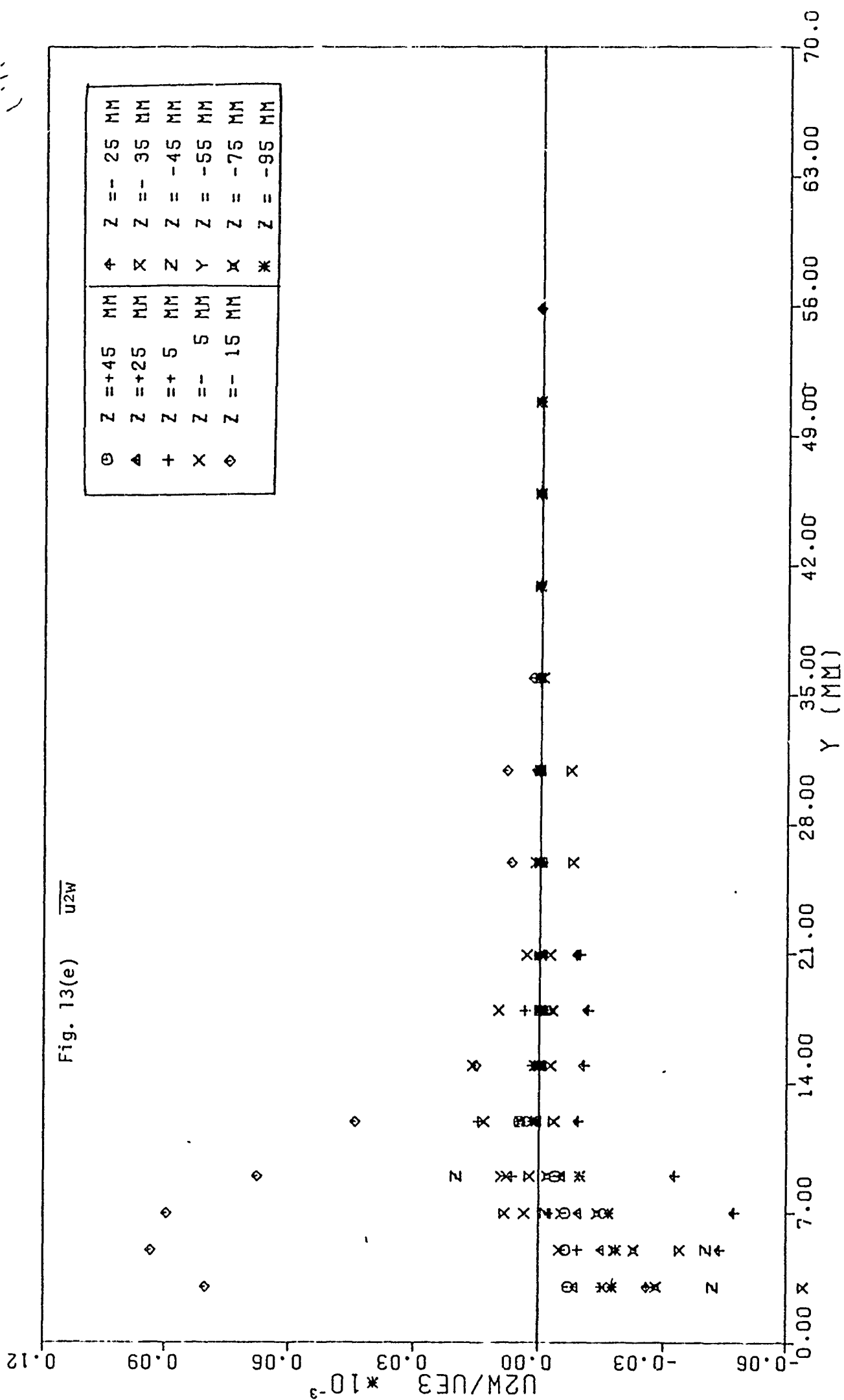
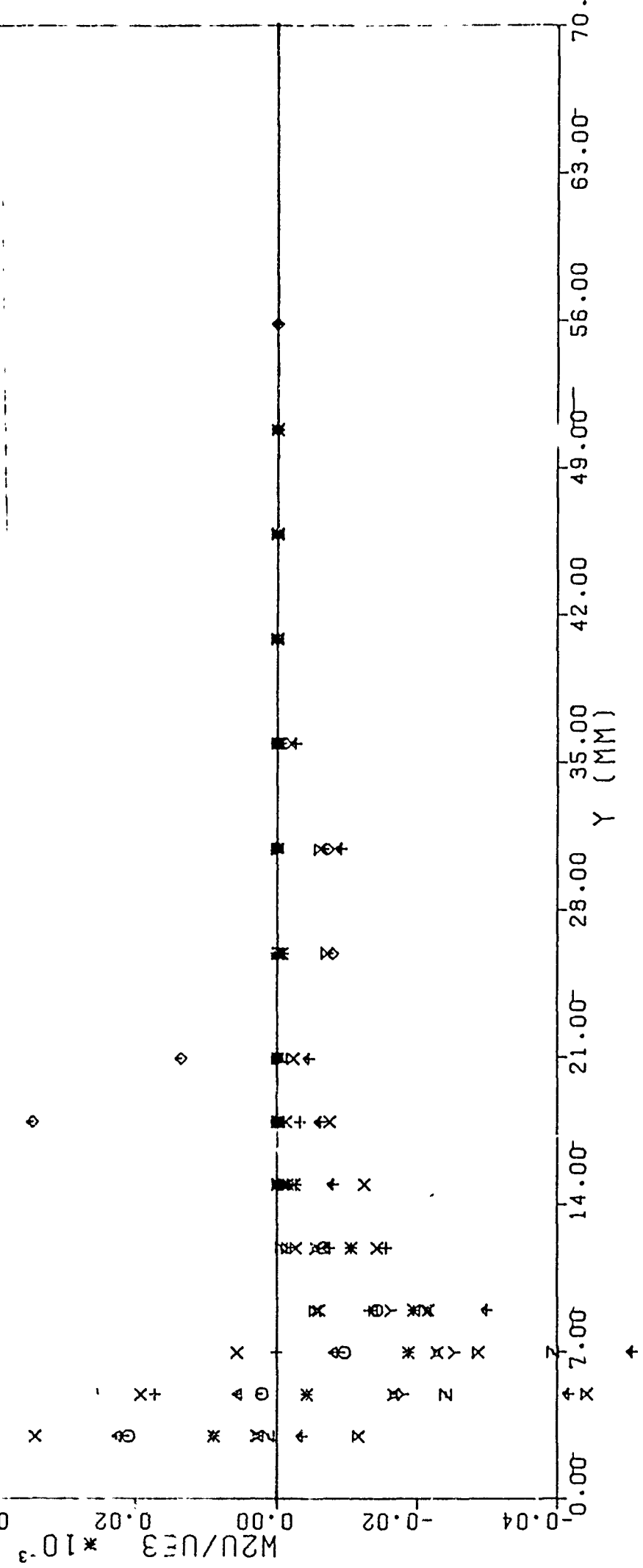


Fig. 13(f)  $\overline{uw^2}$

⊙	Z = +45	MM	4	Z = -25	MM
△	Z = +25	MM	X	Z = -35	MM
+	Z = +5	MM	Z	Z = -45	MM
X	Z = -5	MM	Y	Z = -55	MM
◇	Z = -15	MM	X	Z = -75	MM
			*	Z = -95	MM



U.I.

Fig. 13(g)  $\overline{W^3}$

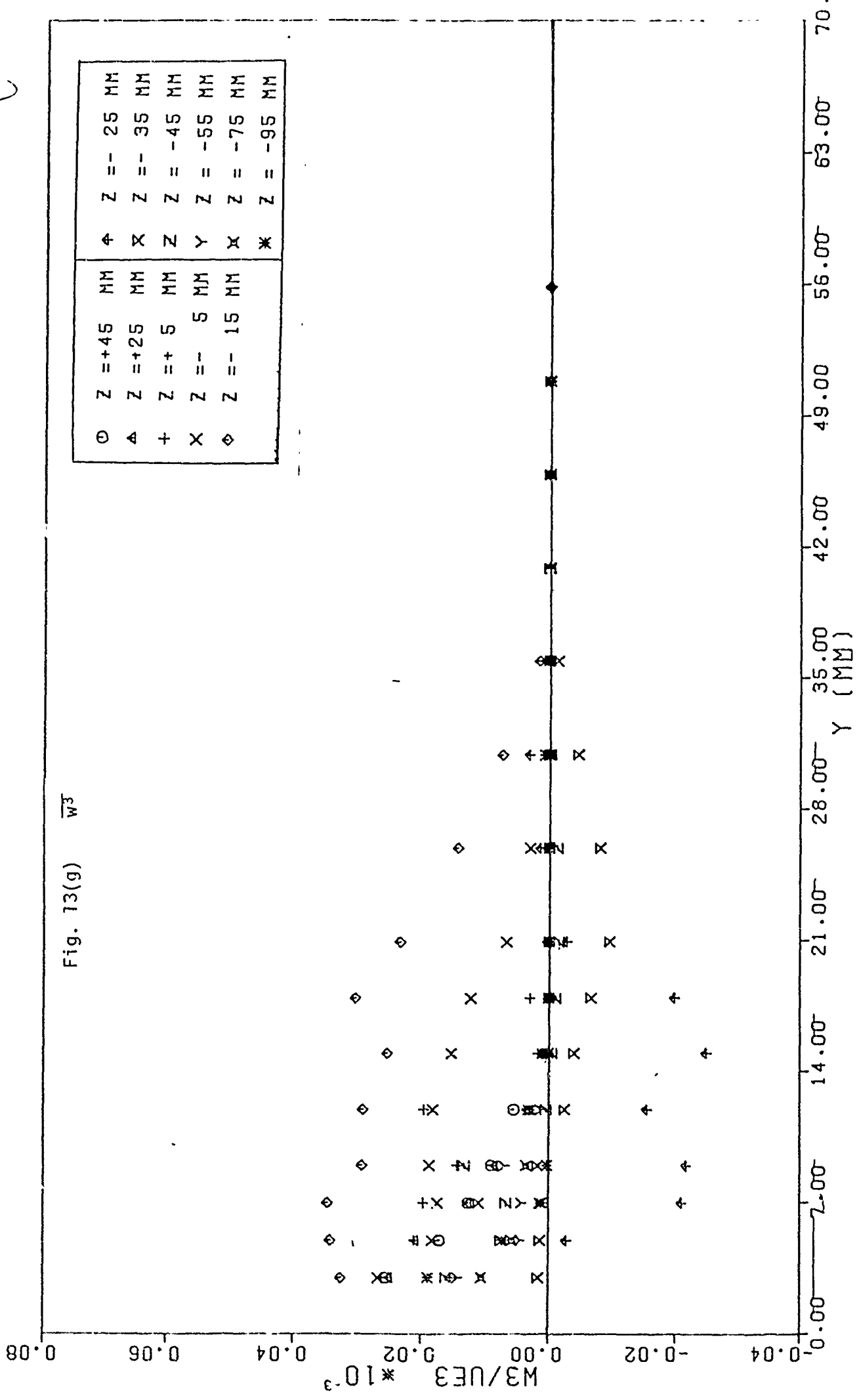
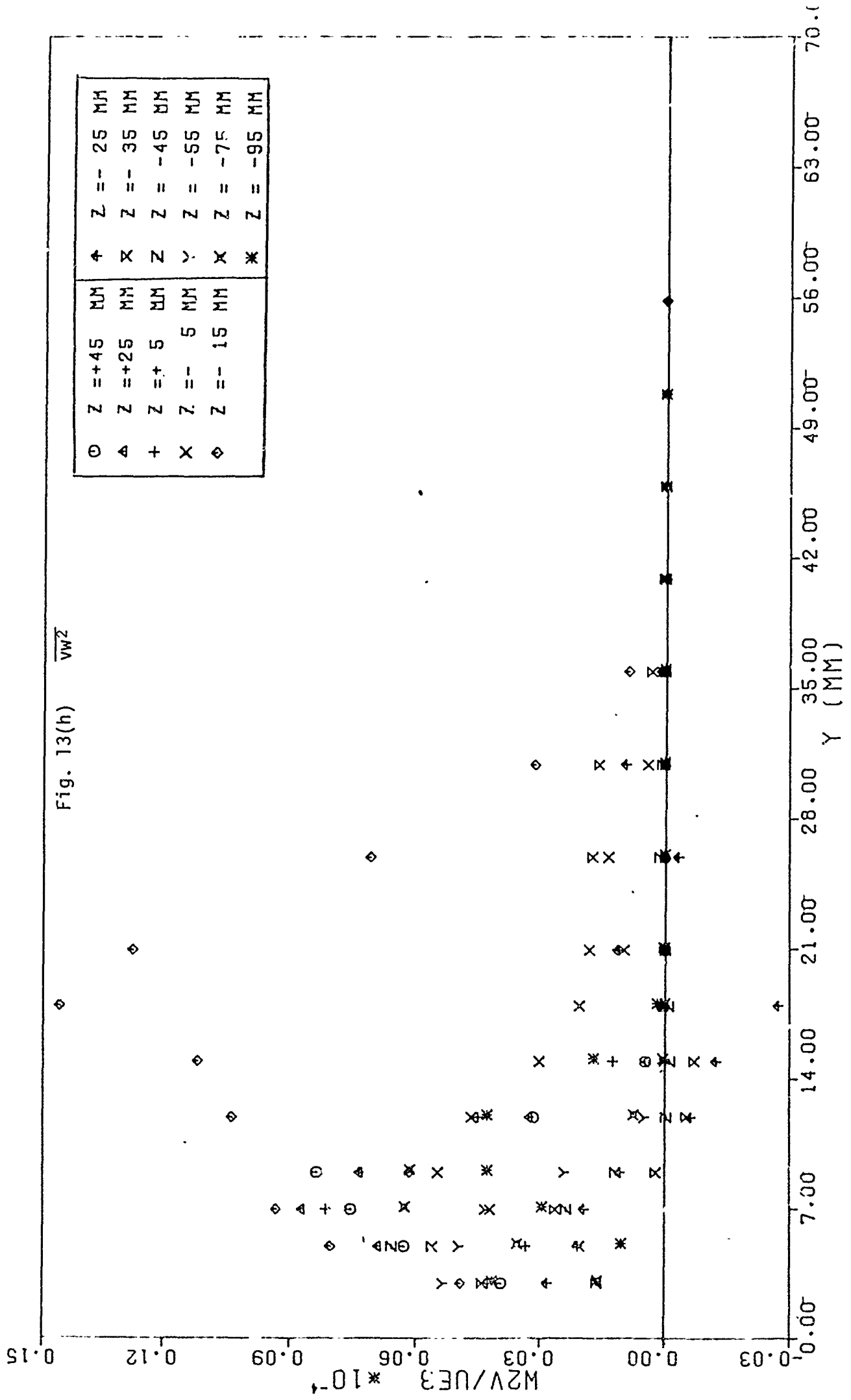
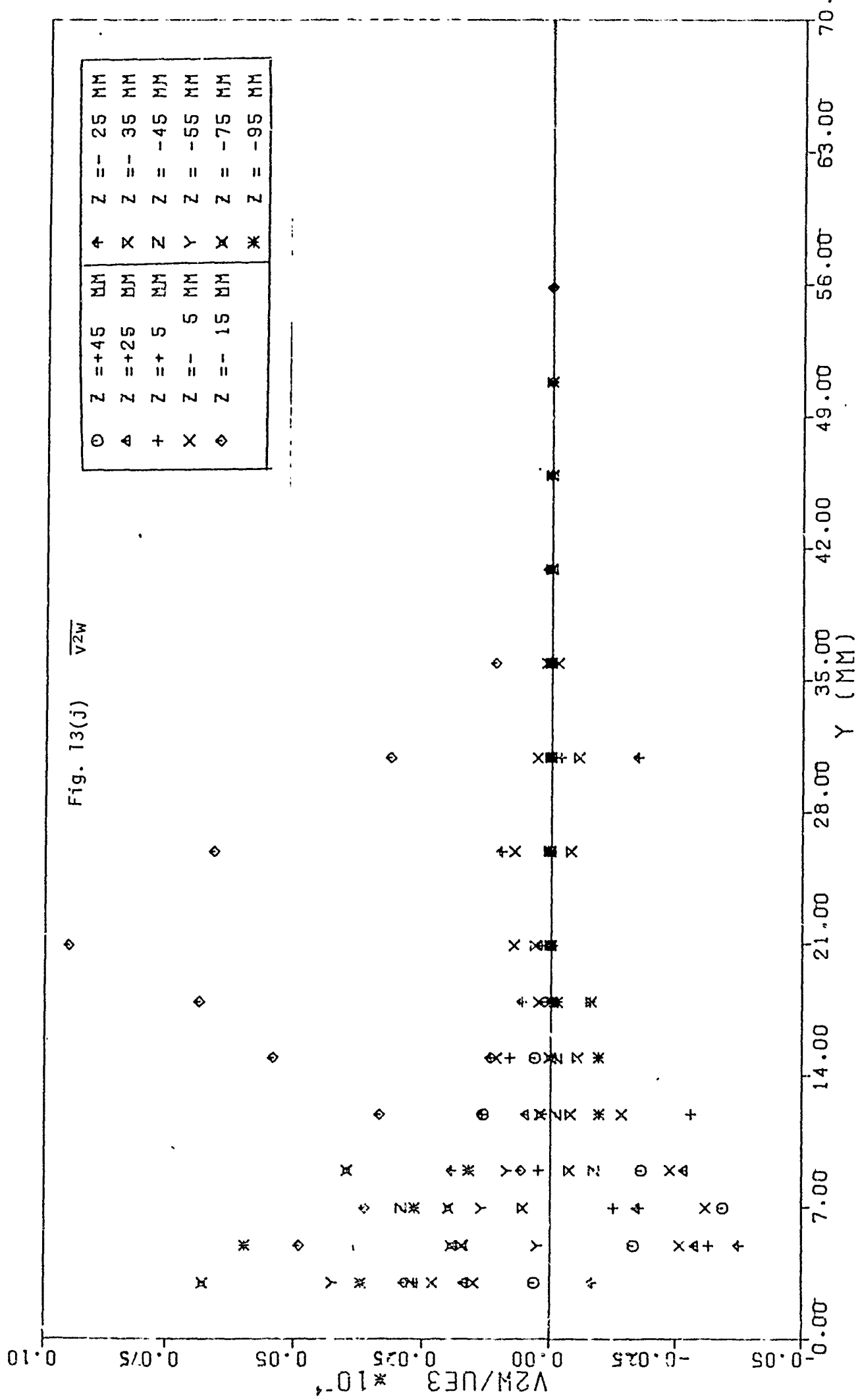
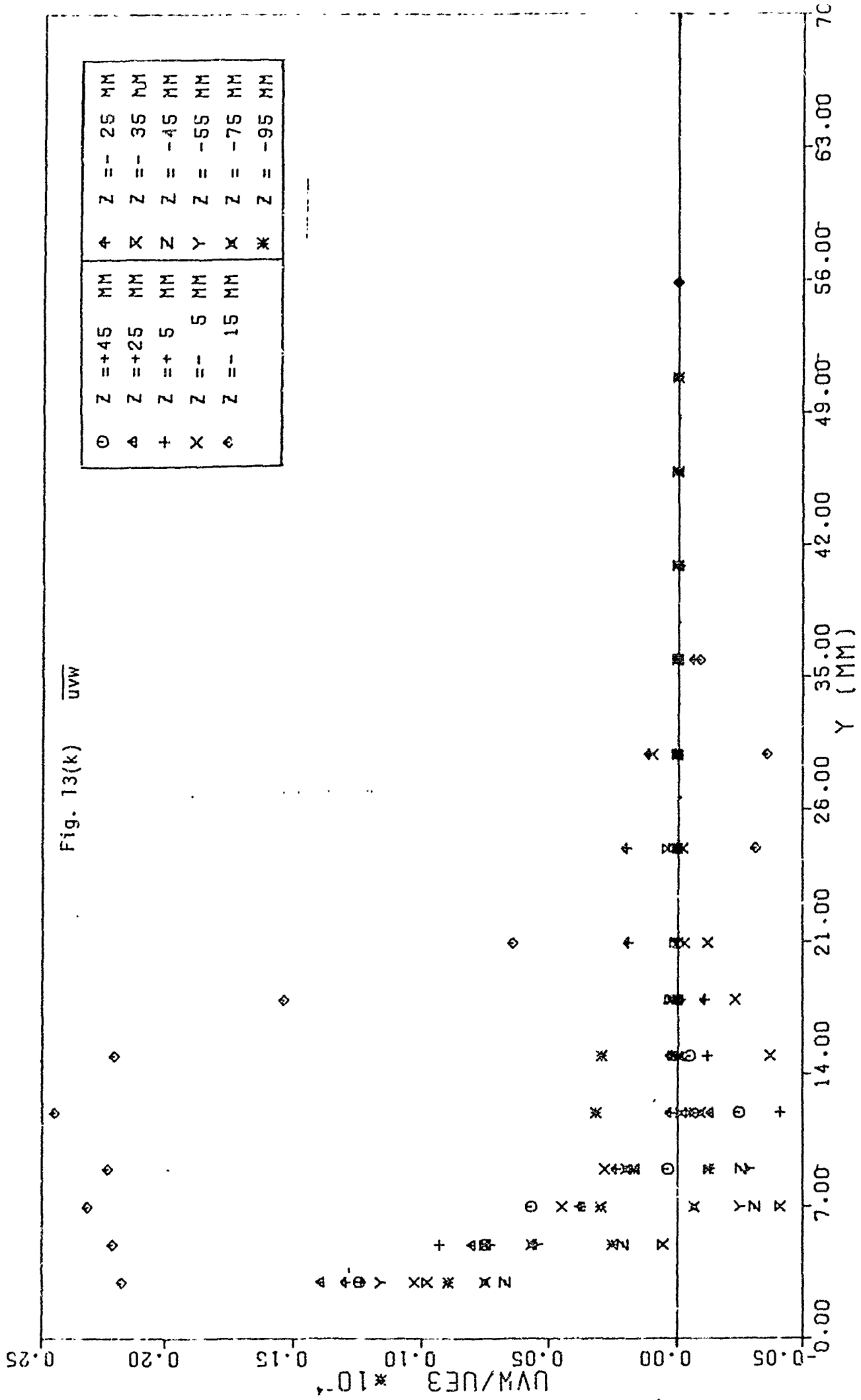


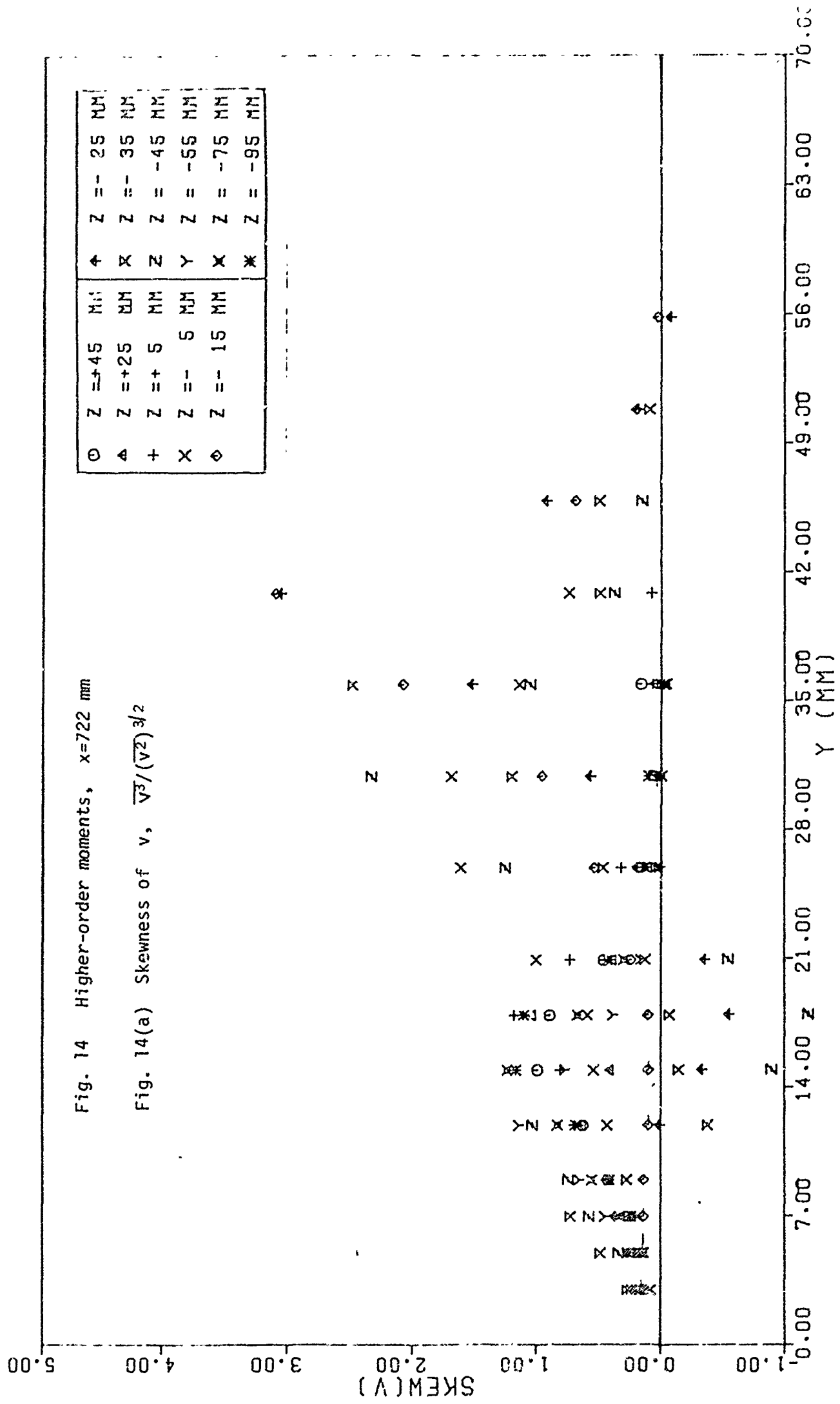
Fig. 13(h)  $\overline{vw^2}$











00.00

25.00

20.00

FLAT(U)

10.00

5.00

0.00

0.00

7.00

14.00

21.00

28.00

35.00

42.00

49.00

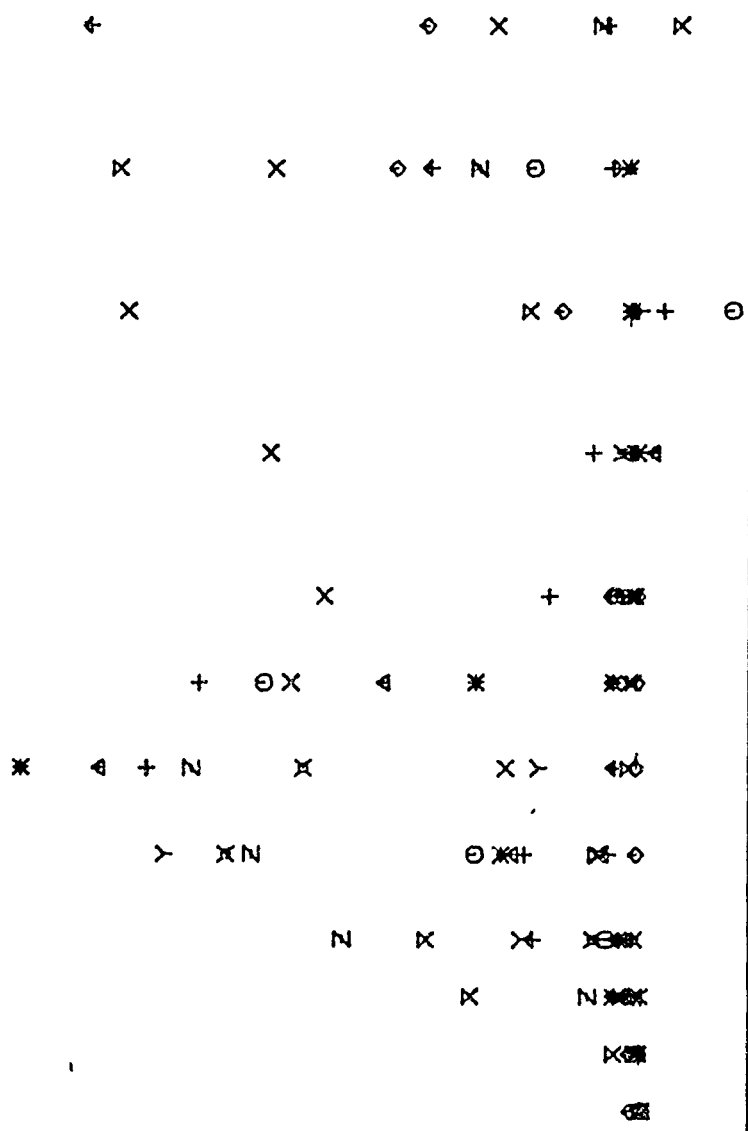
56.00

63.00

70

Fig. 14(b) Flatness of  $u$ ,  $\overline{u^4}/(\overline{u^2})^2$

⊖	Z = +45	MM	↑	Z = -25	MM
△	Z = +25	MM	×	Z = -35	MM
+	Z = +5	MM	Z	Z = -45	MM
×	Z = -5	MM	Y	Z = -55	MM
◇	Z = -15	MM	×	Z = -75	MM
			*	Z = -95	MM



△

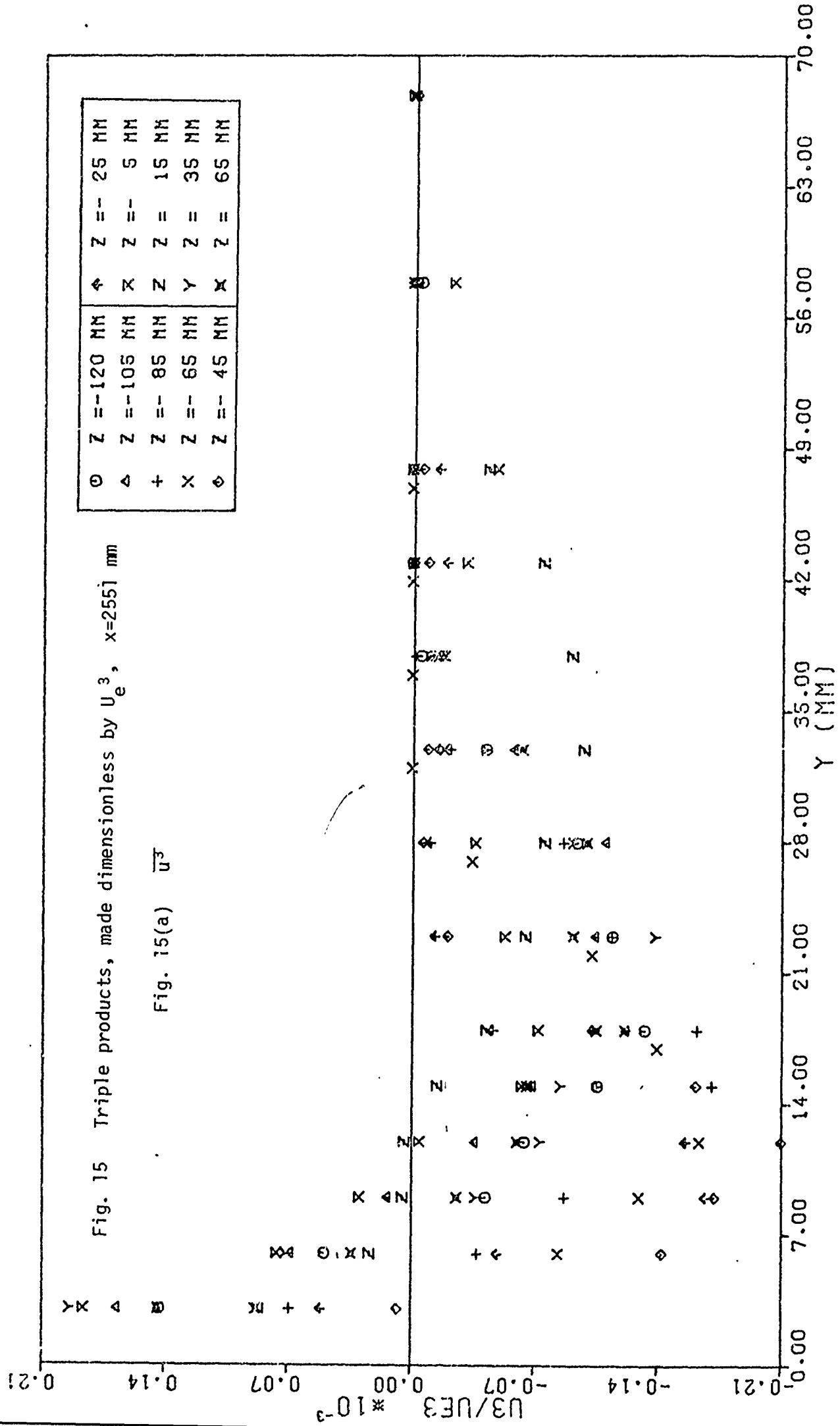
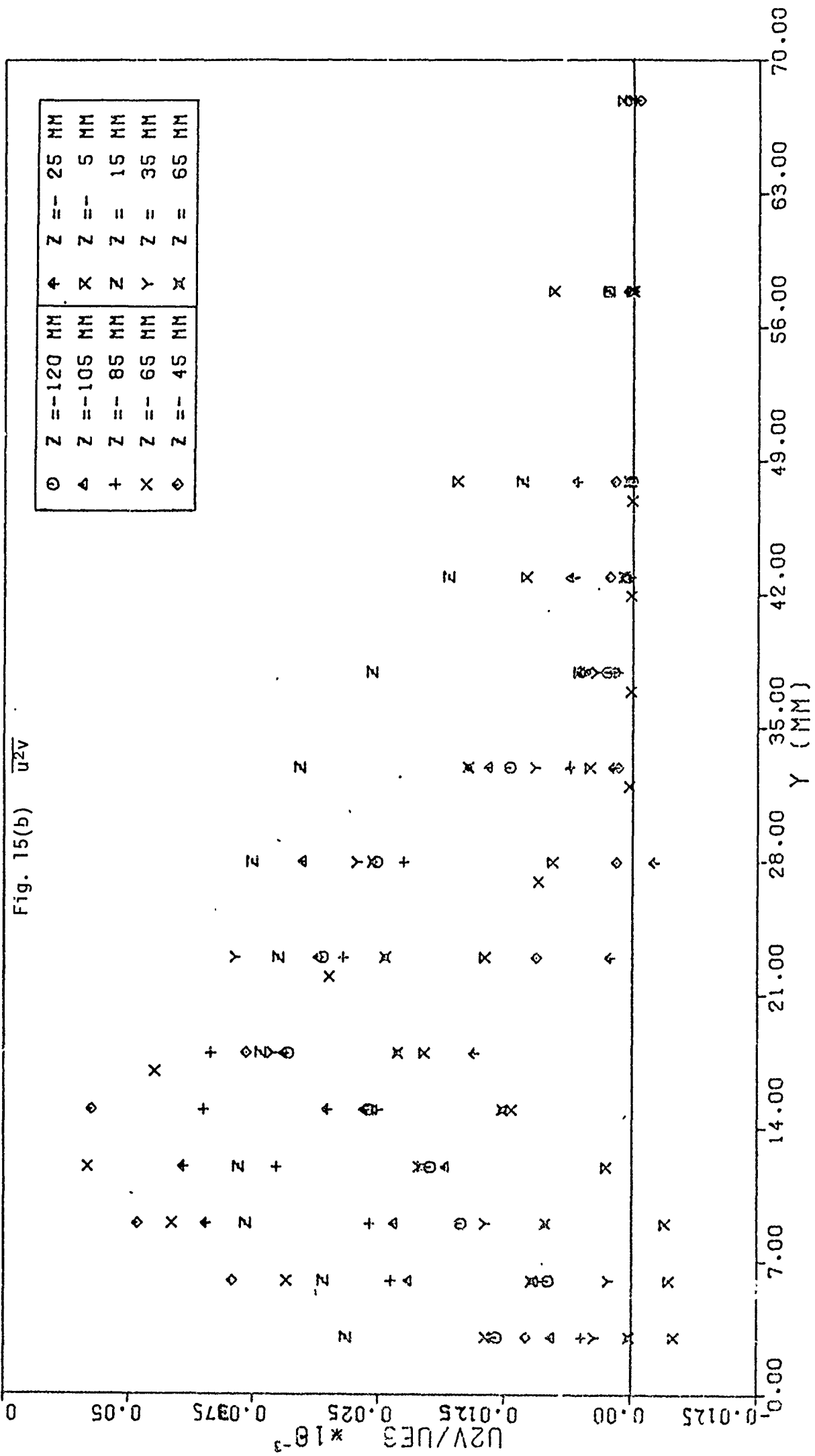
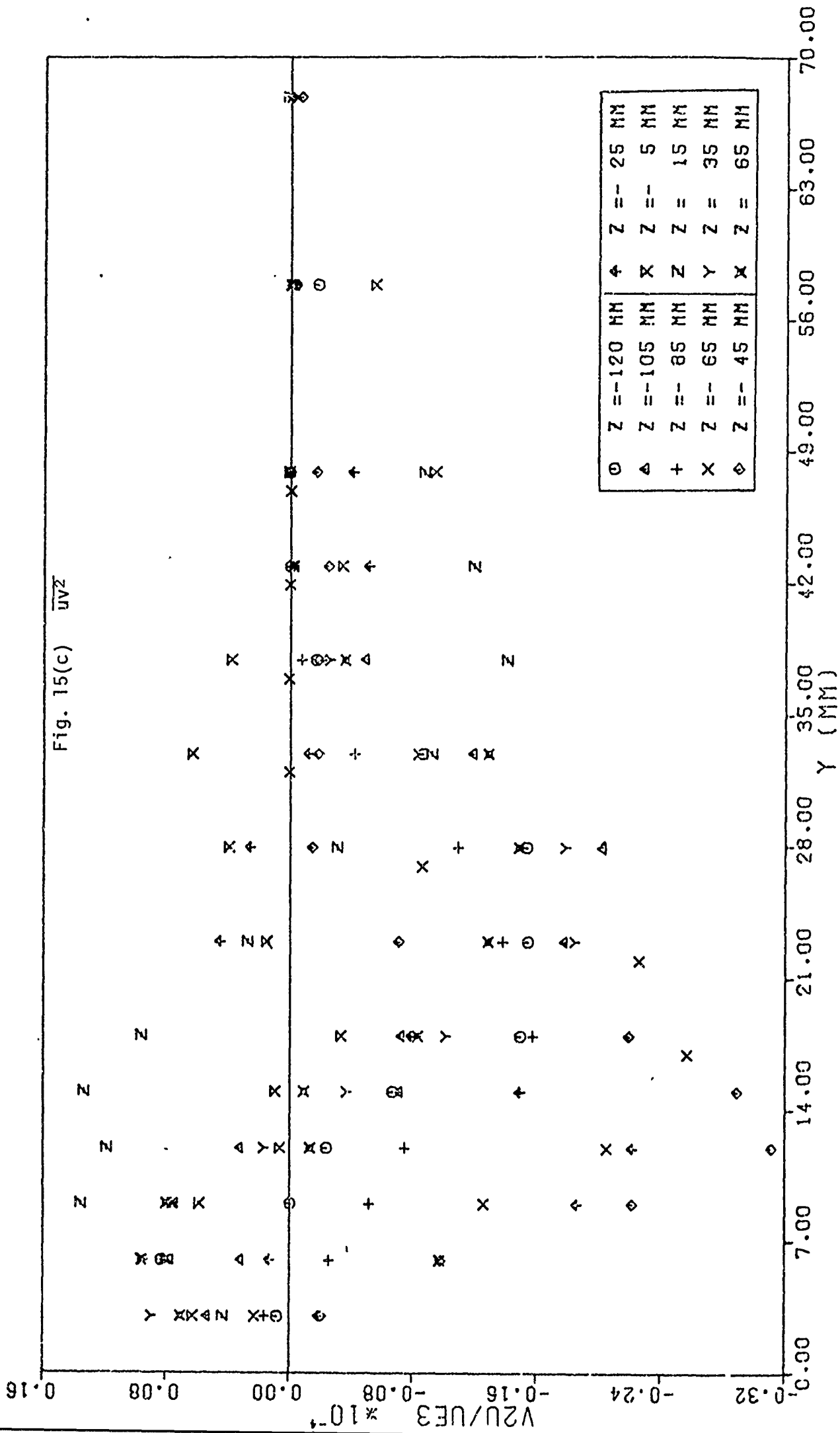
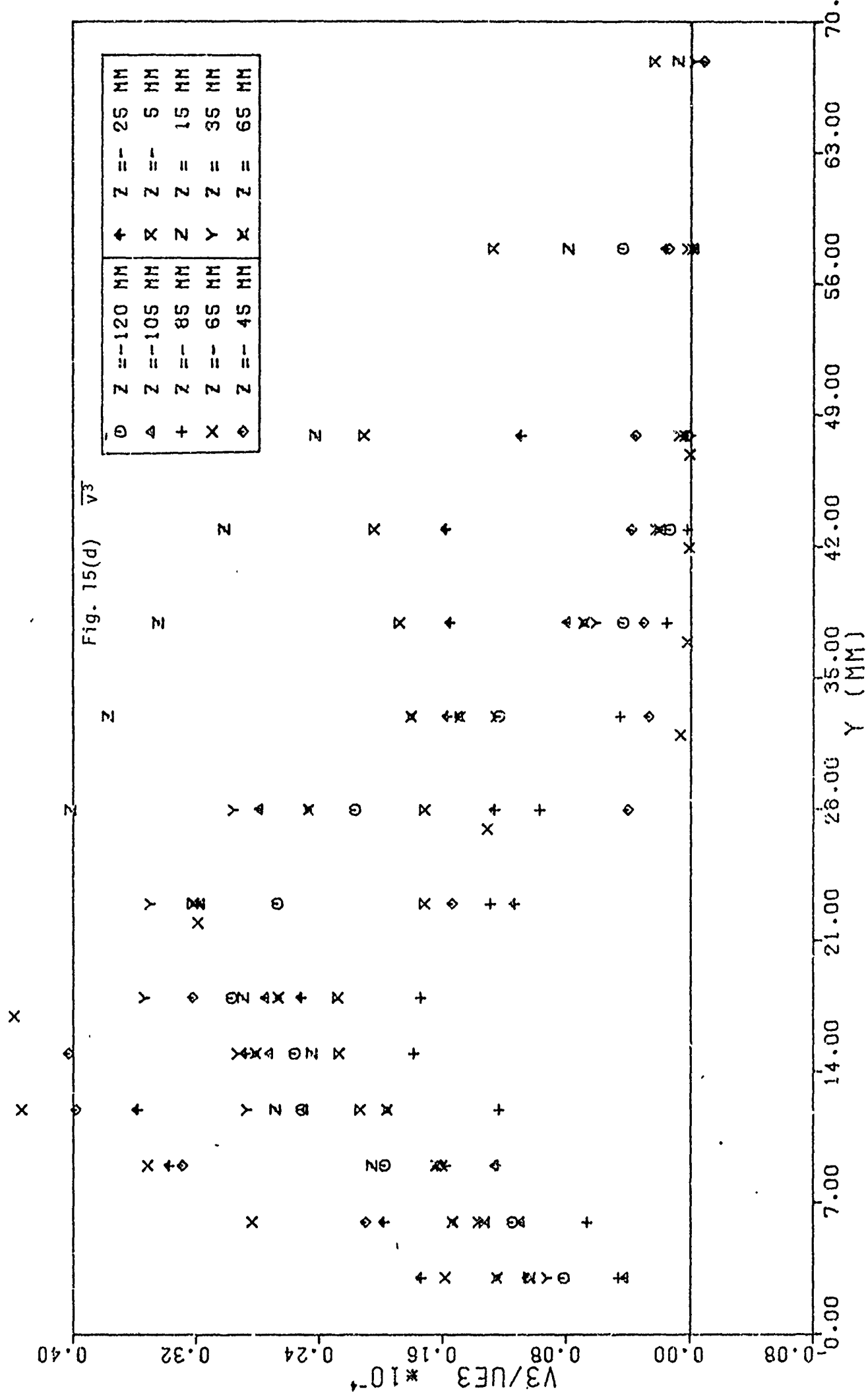


Fig. 15(b)  $\overline{u^2v}$







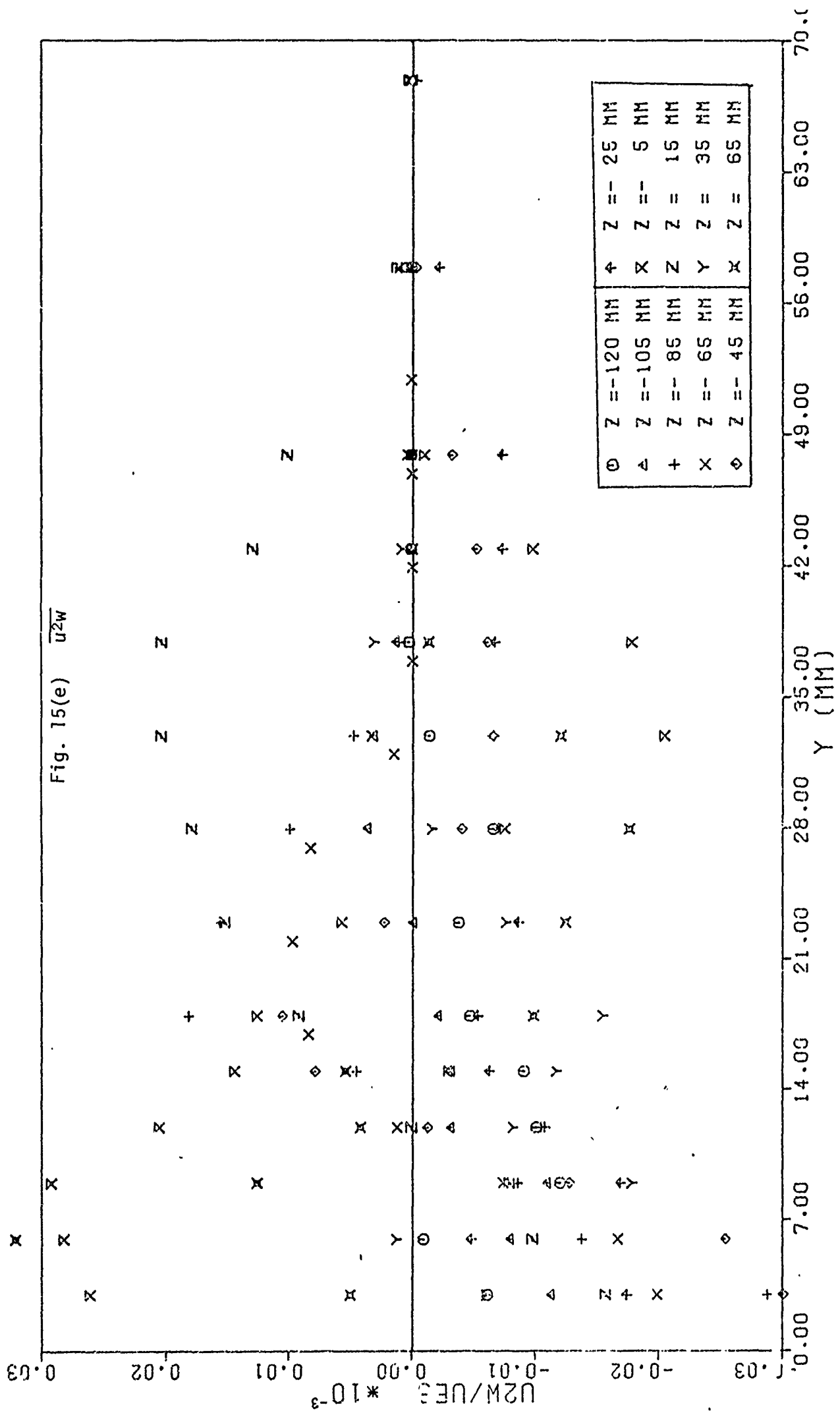




Fig. 15(f)  $\overline{uw^2}$

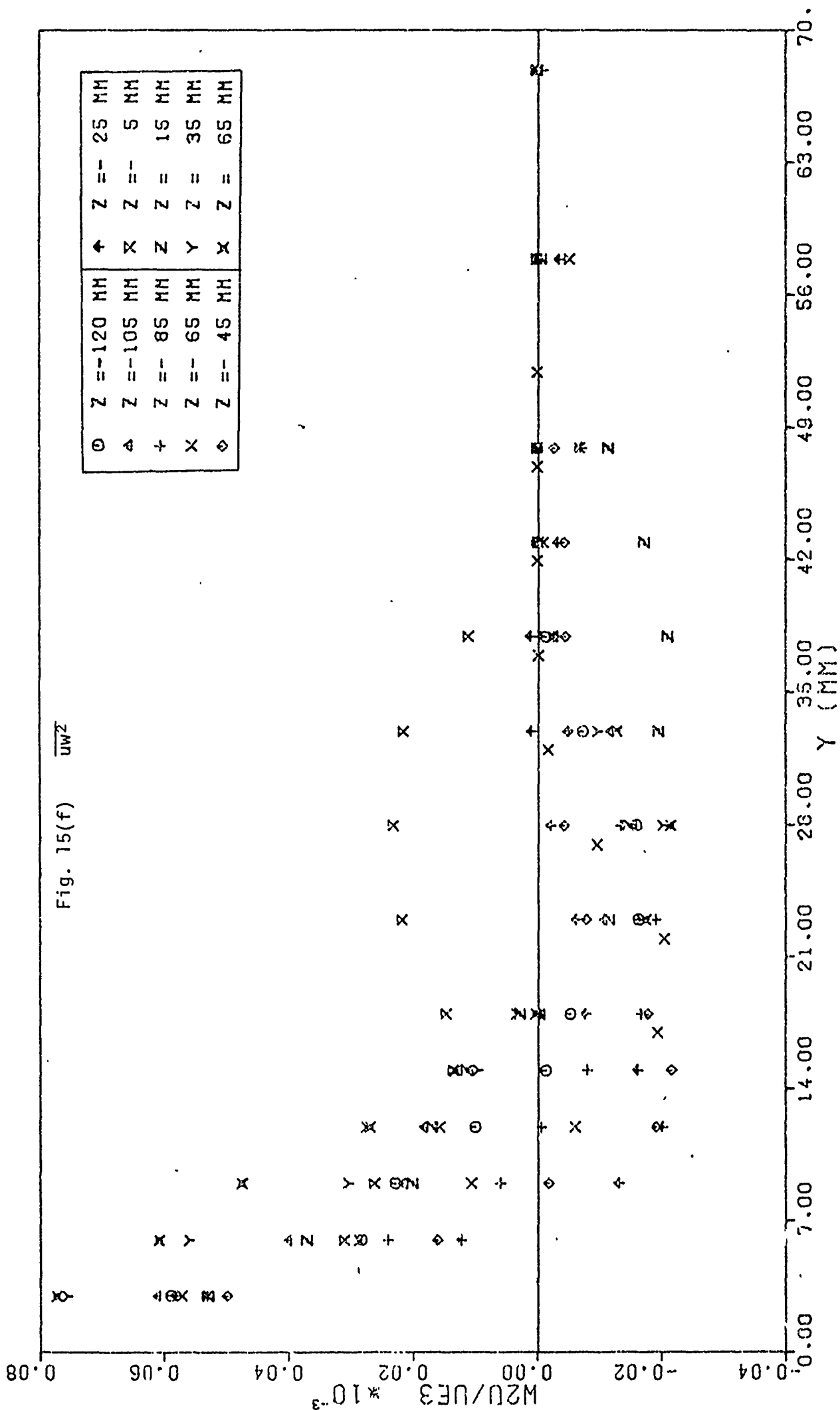


Fig. 15(g)  $\overline{w^3}$

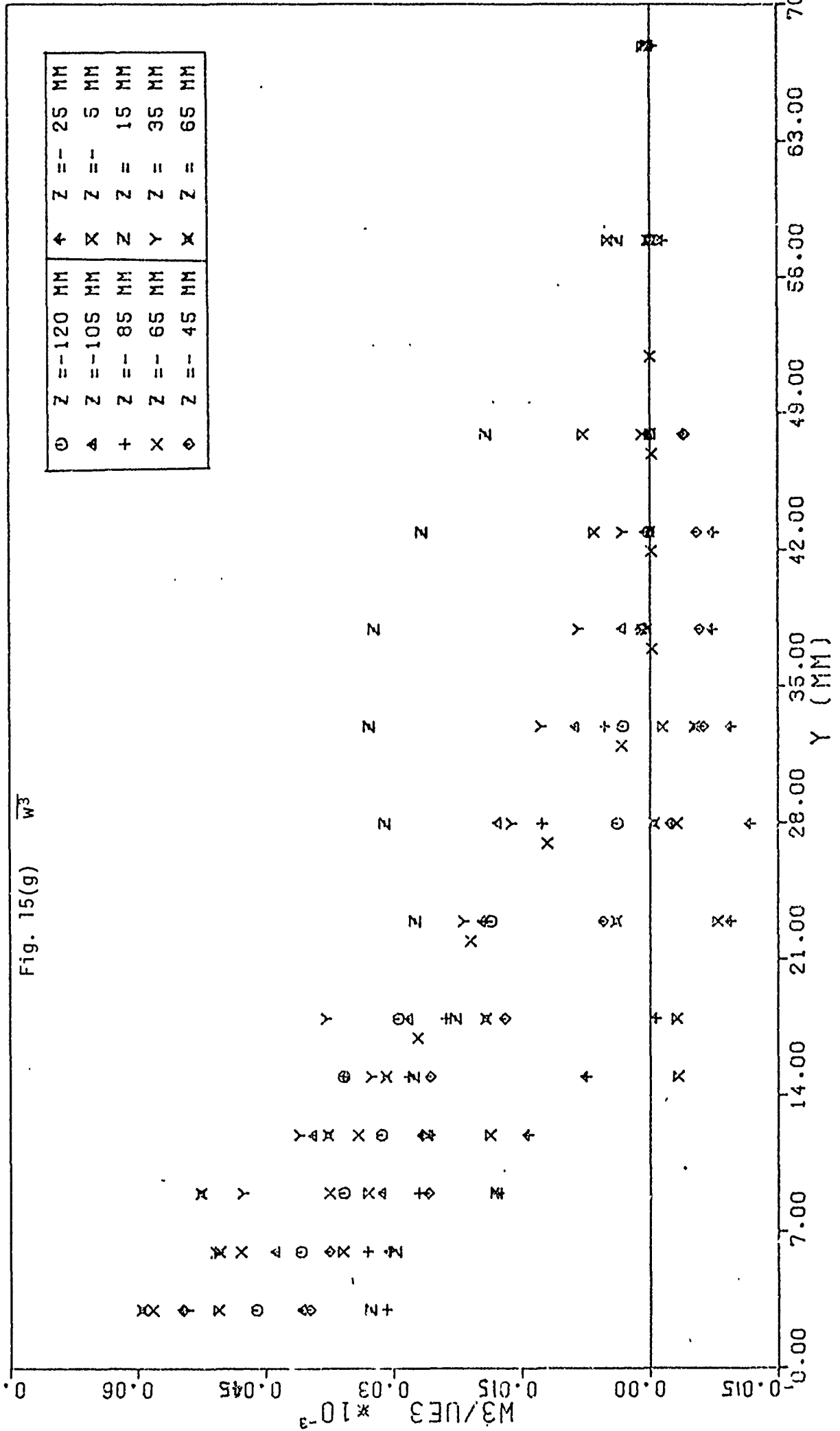


Fig. 15(h)  $\overline{vw^2}$

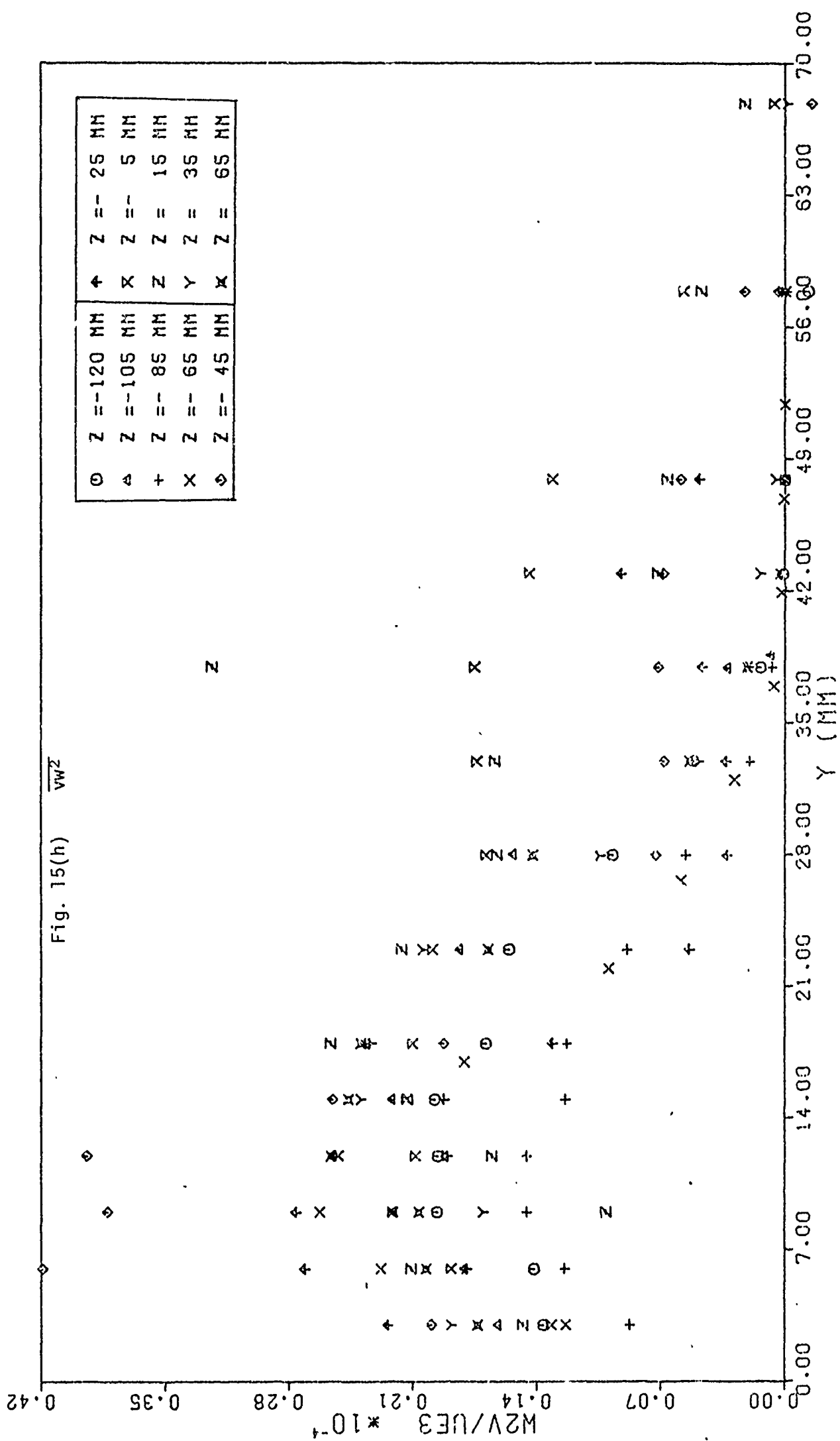


Fig. 15(j)  $V^2W$

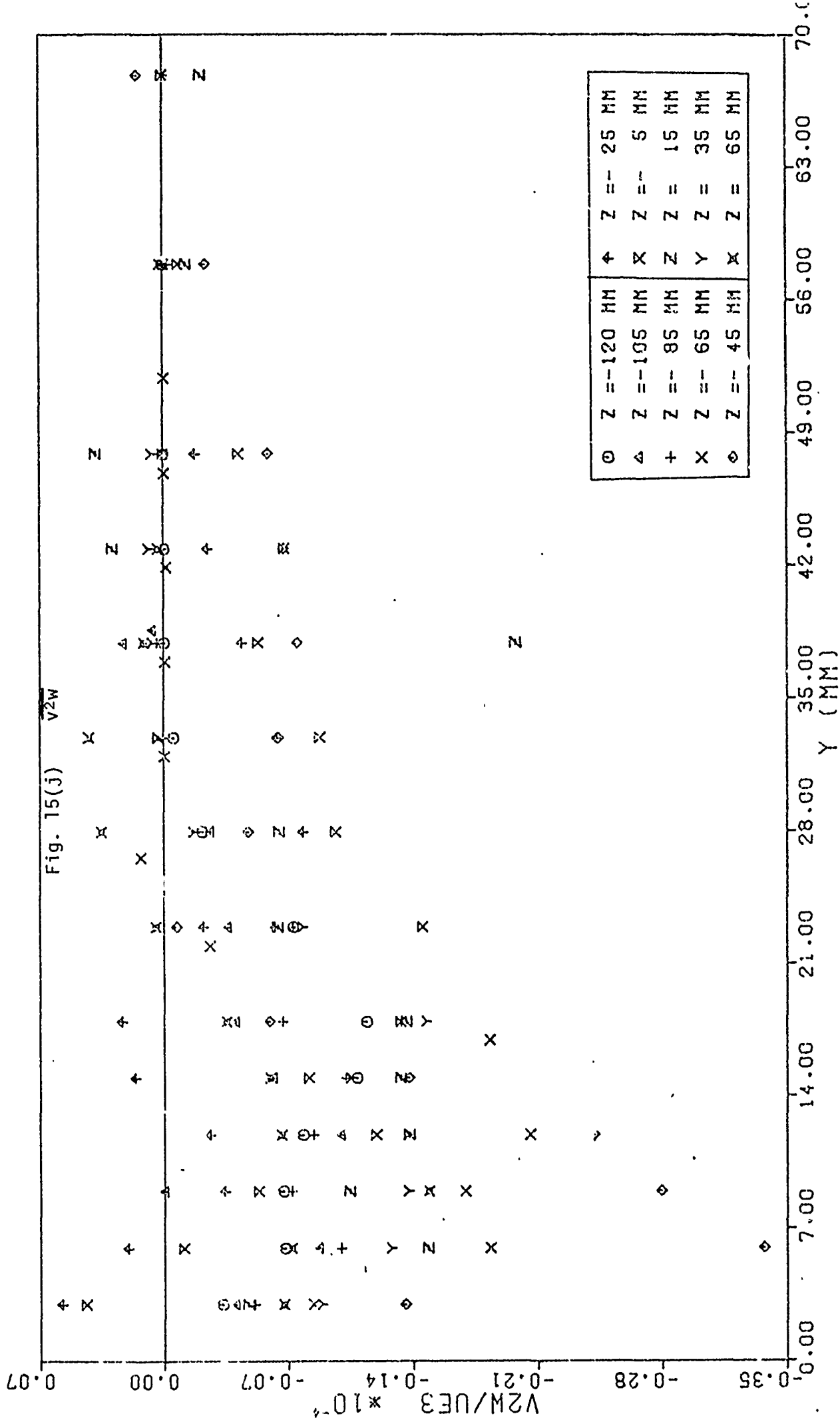
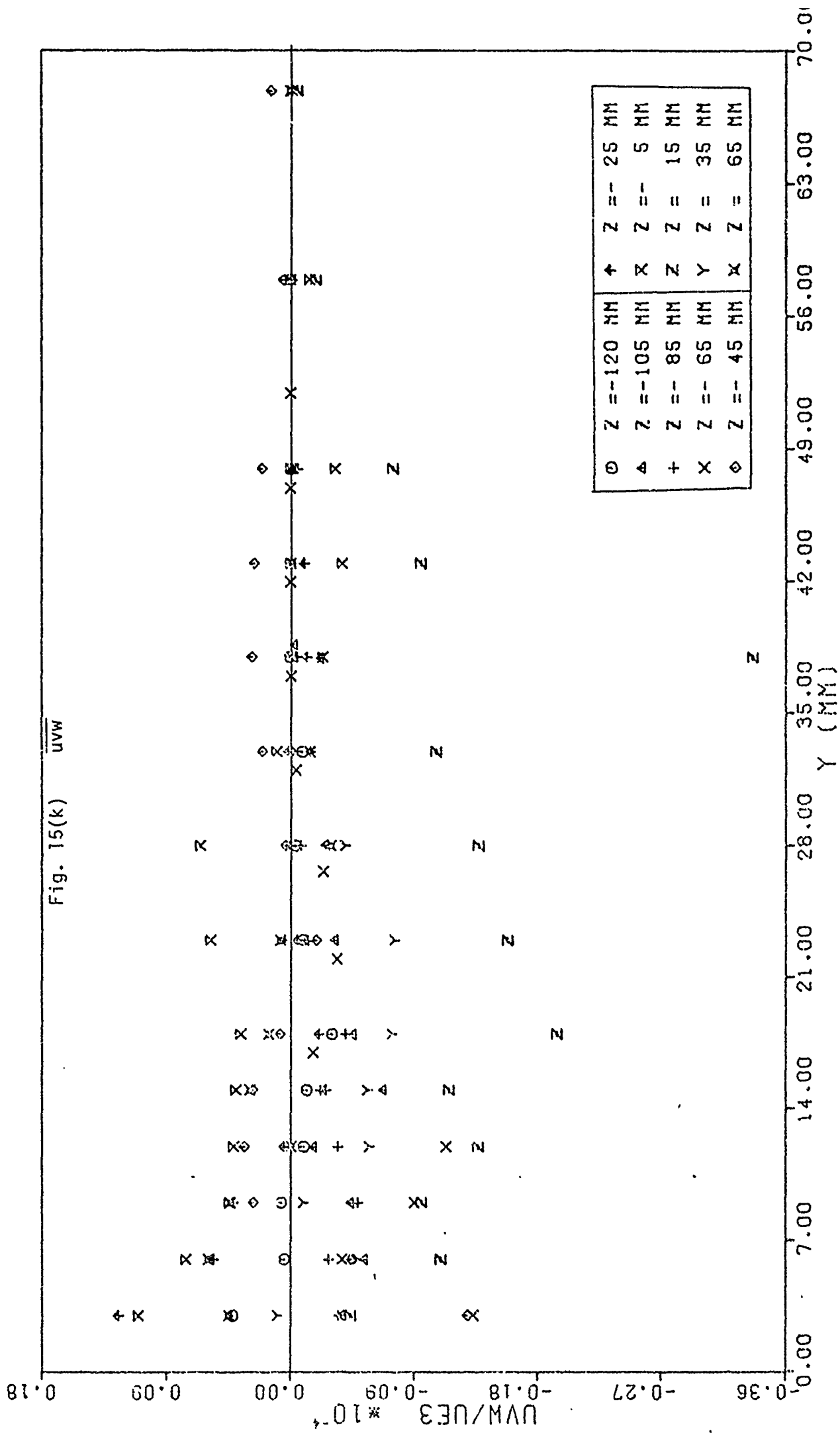


Fig. 15(k)  $\overline{UVW}$



SKEM(V)

Fig. 16 Higher-order moments, x=2551 mm

Fig. 16(a)

Skewness of v,  $\sqrt[3]{v^3/(v^2)^{3/2}}$

0	Z = -120 MM	+	Z = -25 MM
Δ	Z = -105 MM	X	Z = -5 MM
+	Z = -85 MM	Z	Z = 15 MM
X	Z = -65 MM	Y	Z = 35 MM
0	Z = -45 MM	X	Z = 65 MM

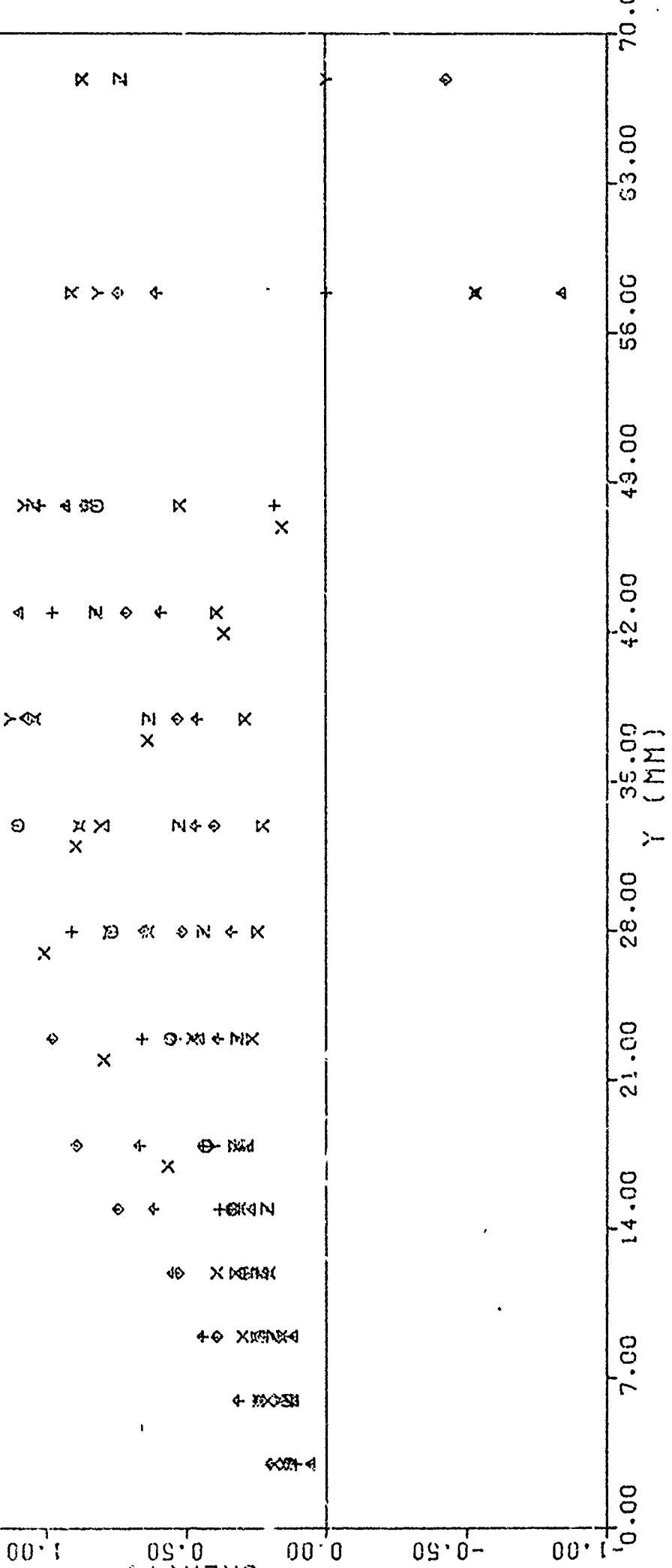


Fig. 16(b) Flatness of  $u$ ,  $\overline{u^2}/(\overline{u^2})^2$

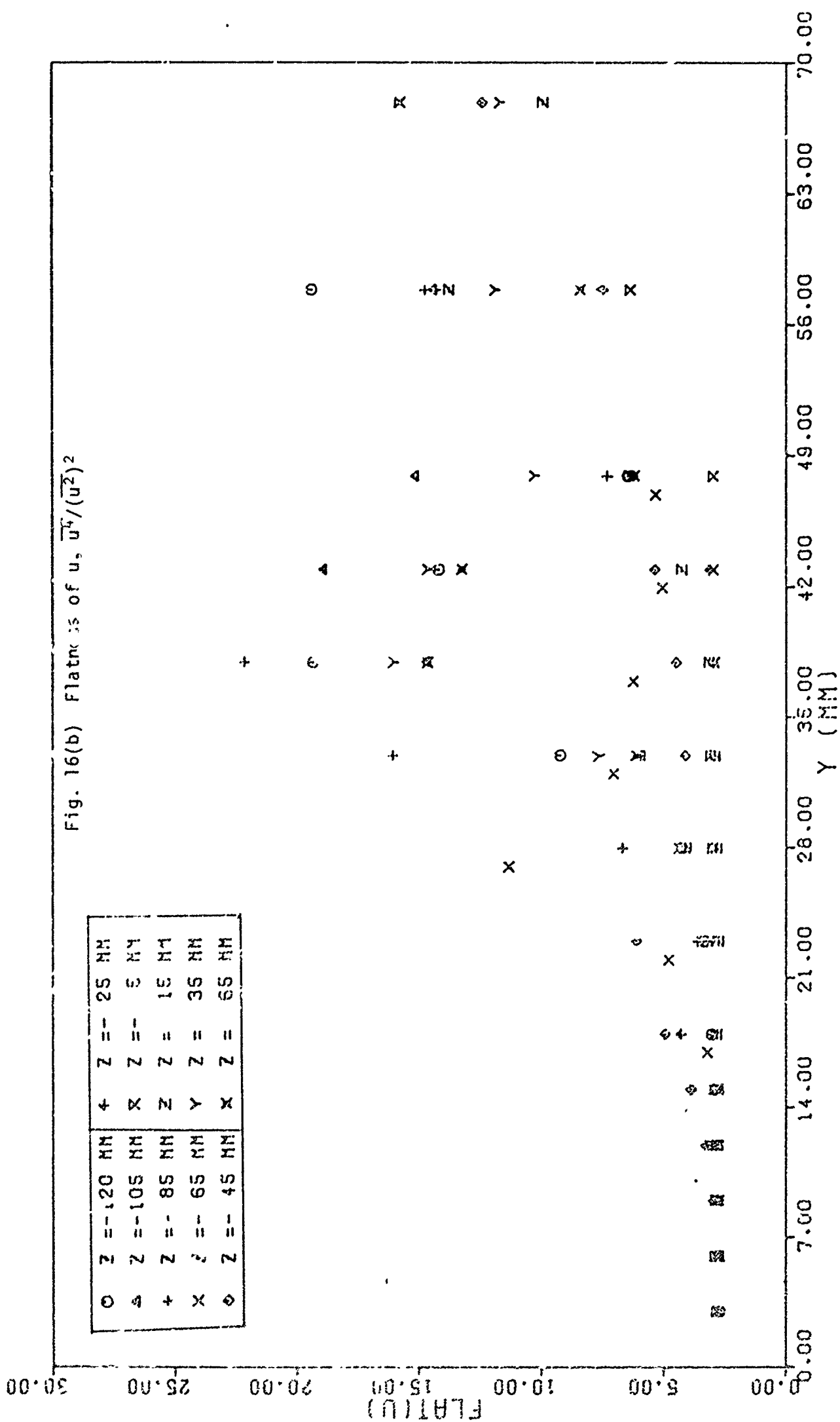


Fig. 16(c)  $\frac{UV^2}{UV}$

0	UV2 = -.02	4	UV2 = .03
4	UV2 = -.01	X	UV2 = .04
+	UV2 = 0.0	Z	UV2 = .05
X	UV2 = .01	Y	UV2 = .06
◇	UV2 = .02	X	UV2 = .07

$$\frac{U}{U_c} = 0.995$$

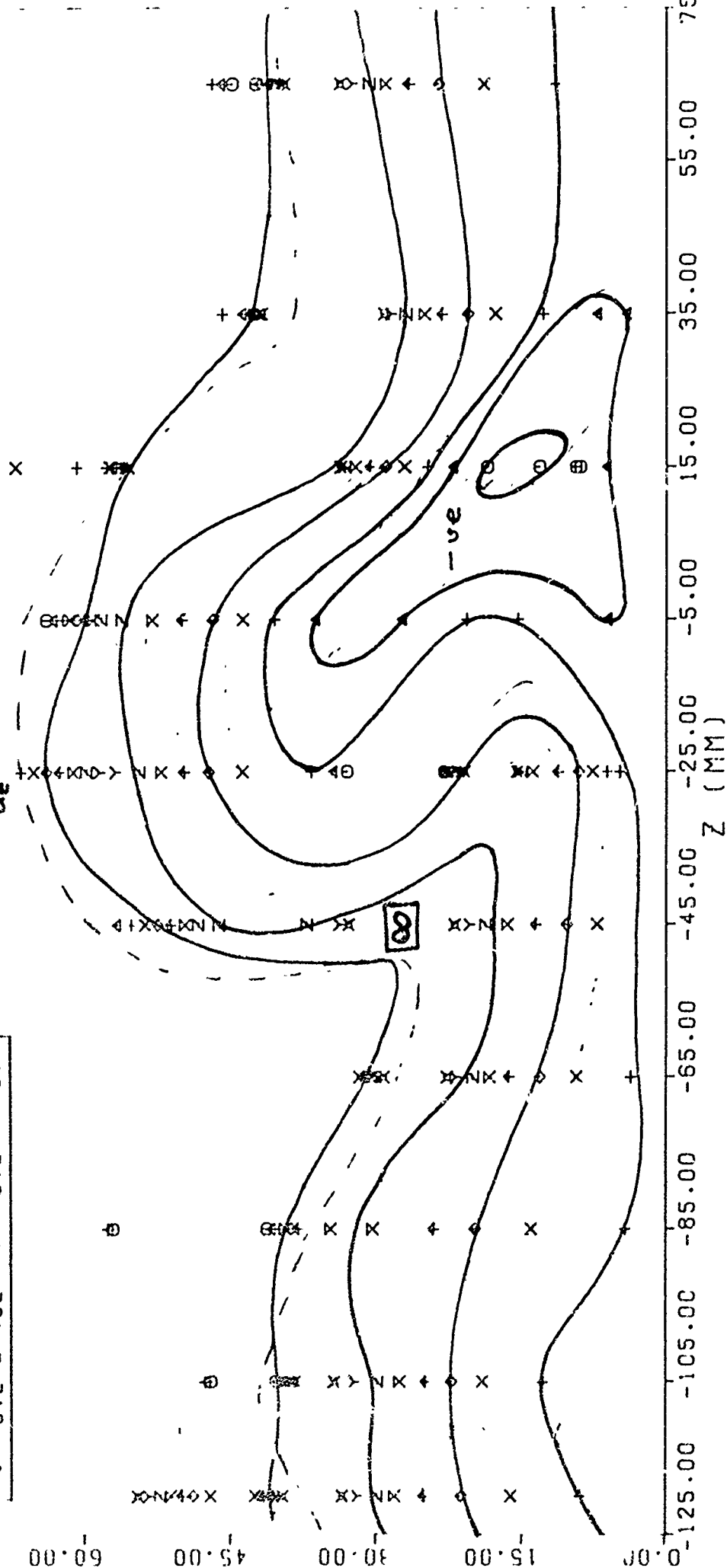
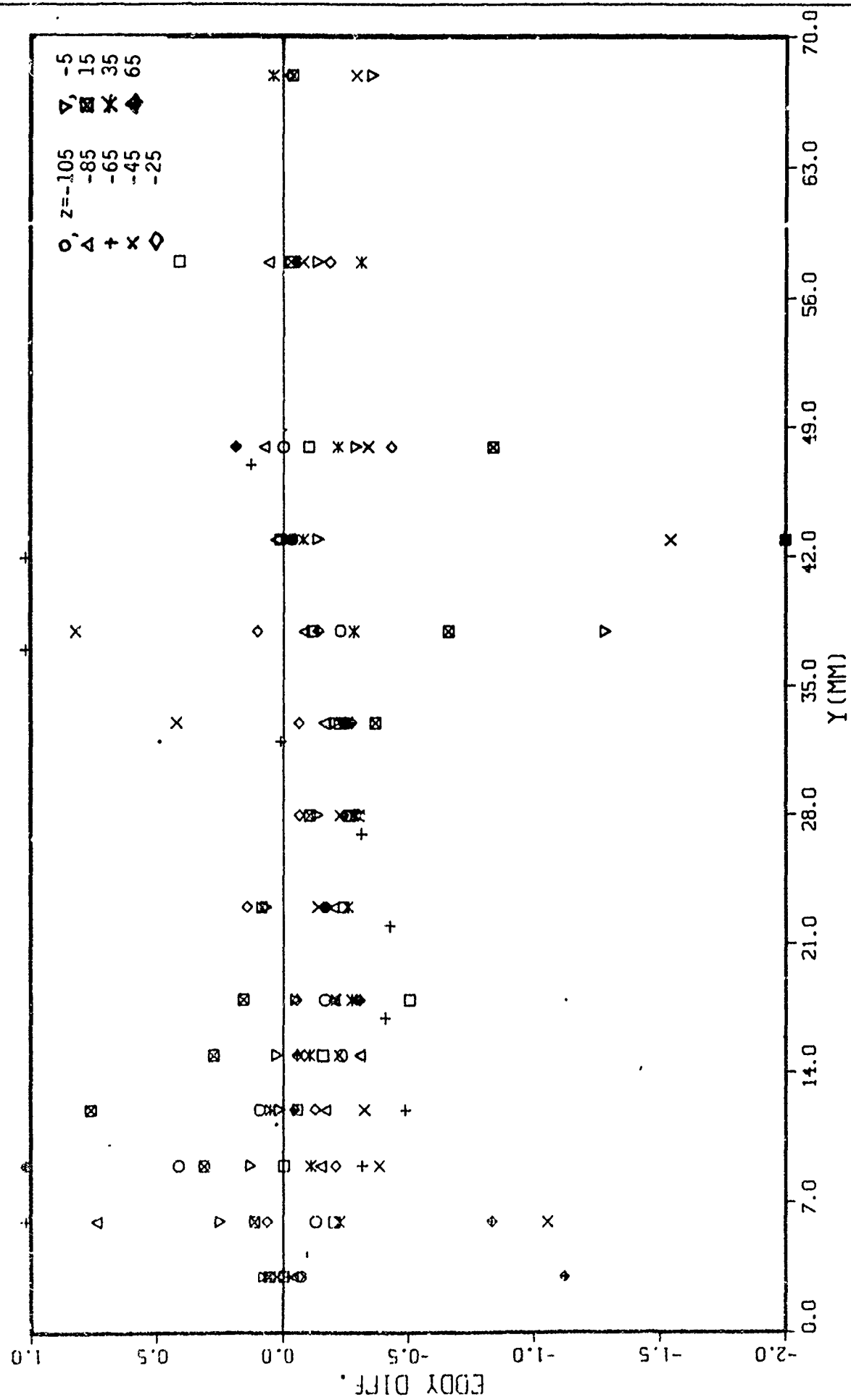




Fig. 16(d) Diffusivity of  $\overline{uv}$ ,  $-\overline{uv^2}/(\partial\overline{uv}/\partial y)$



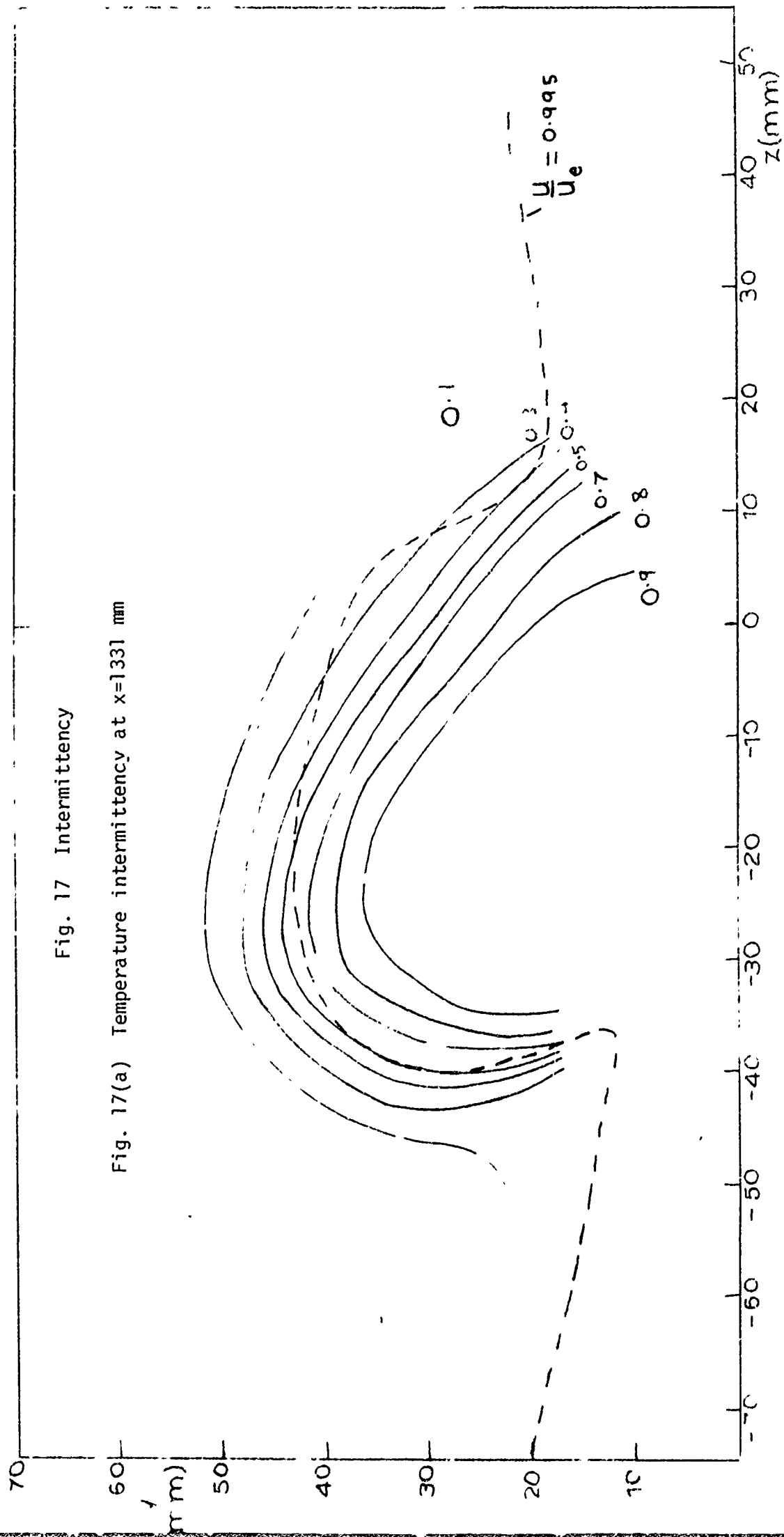


Fig. 17 Intermittency

Fig. 17(a) Temperature intermittency at  $x=1331$  mm

Fig. 17(b) "Velocity" intermittency at  $x=2551$  mm

○	GAMMA = .9	X	GAMMA = .6
△	GAMMA = .8	◇	GAMMA = .5
+	GAMMA = .7		

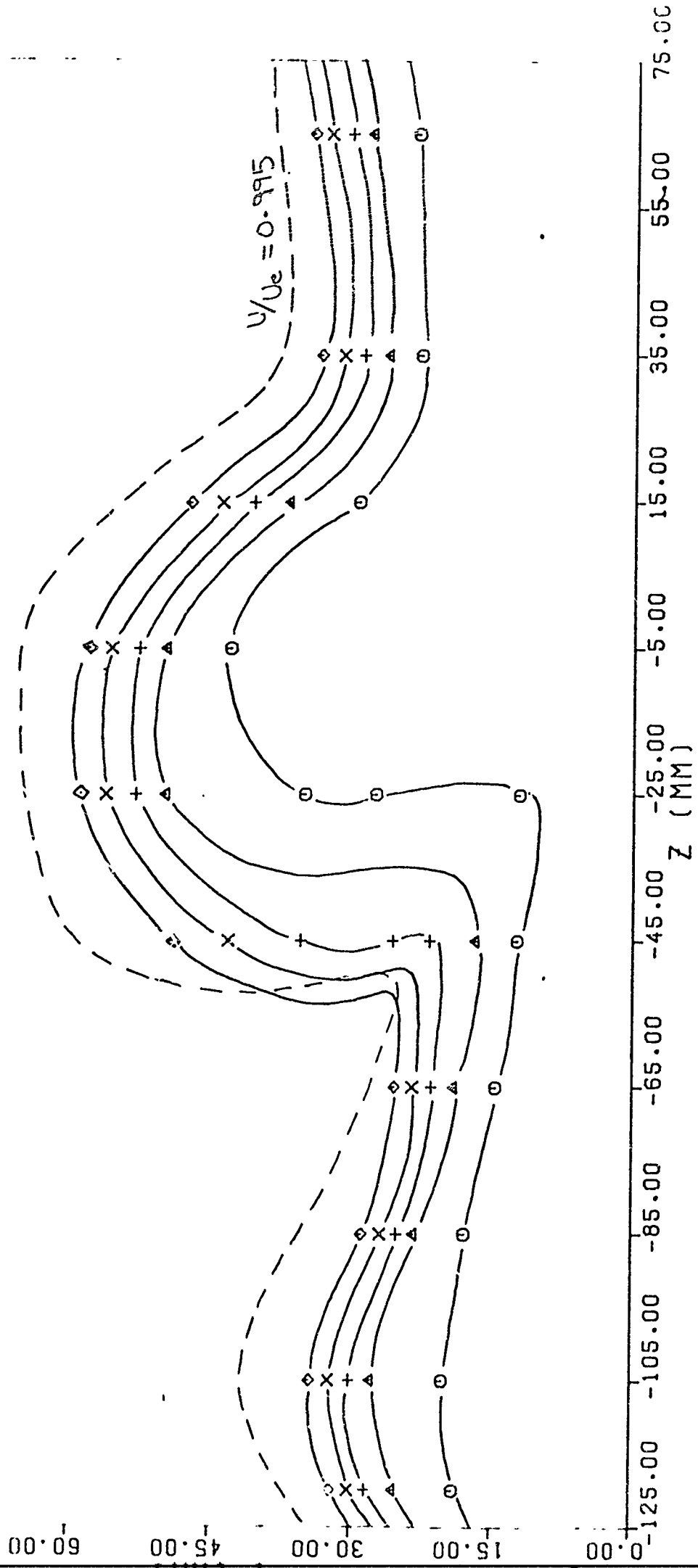
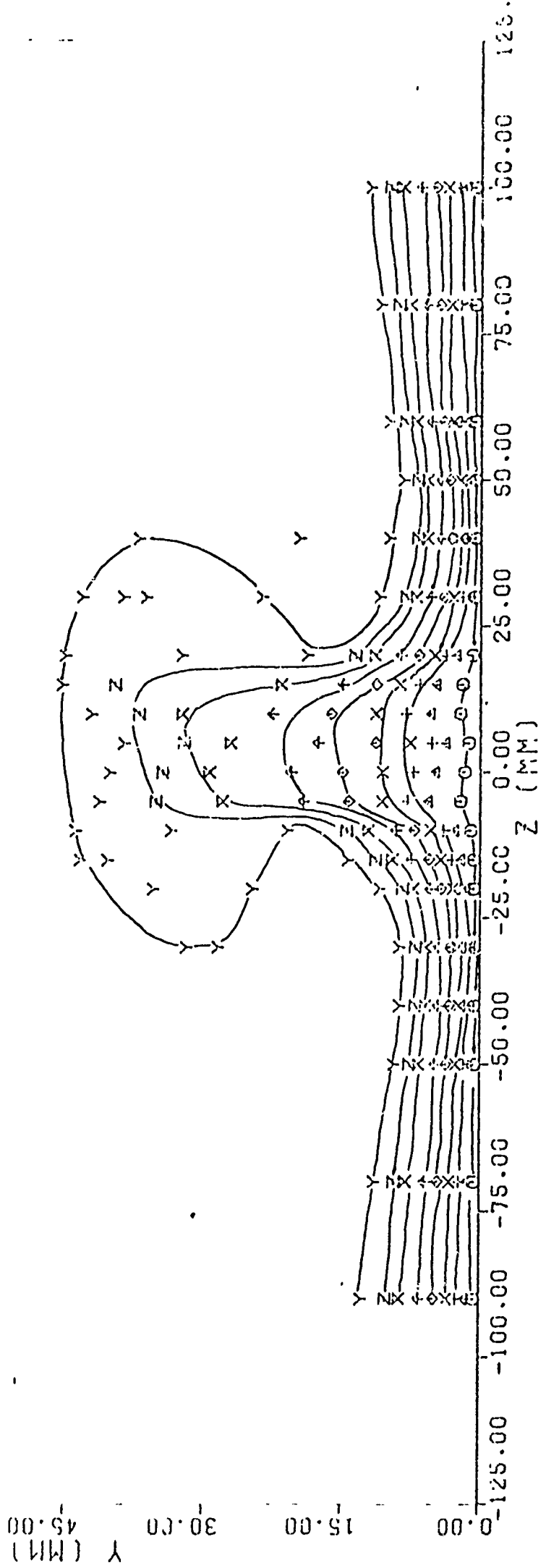
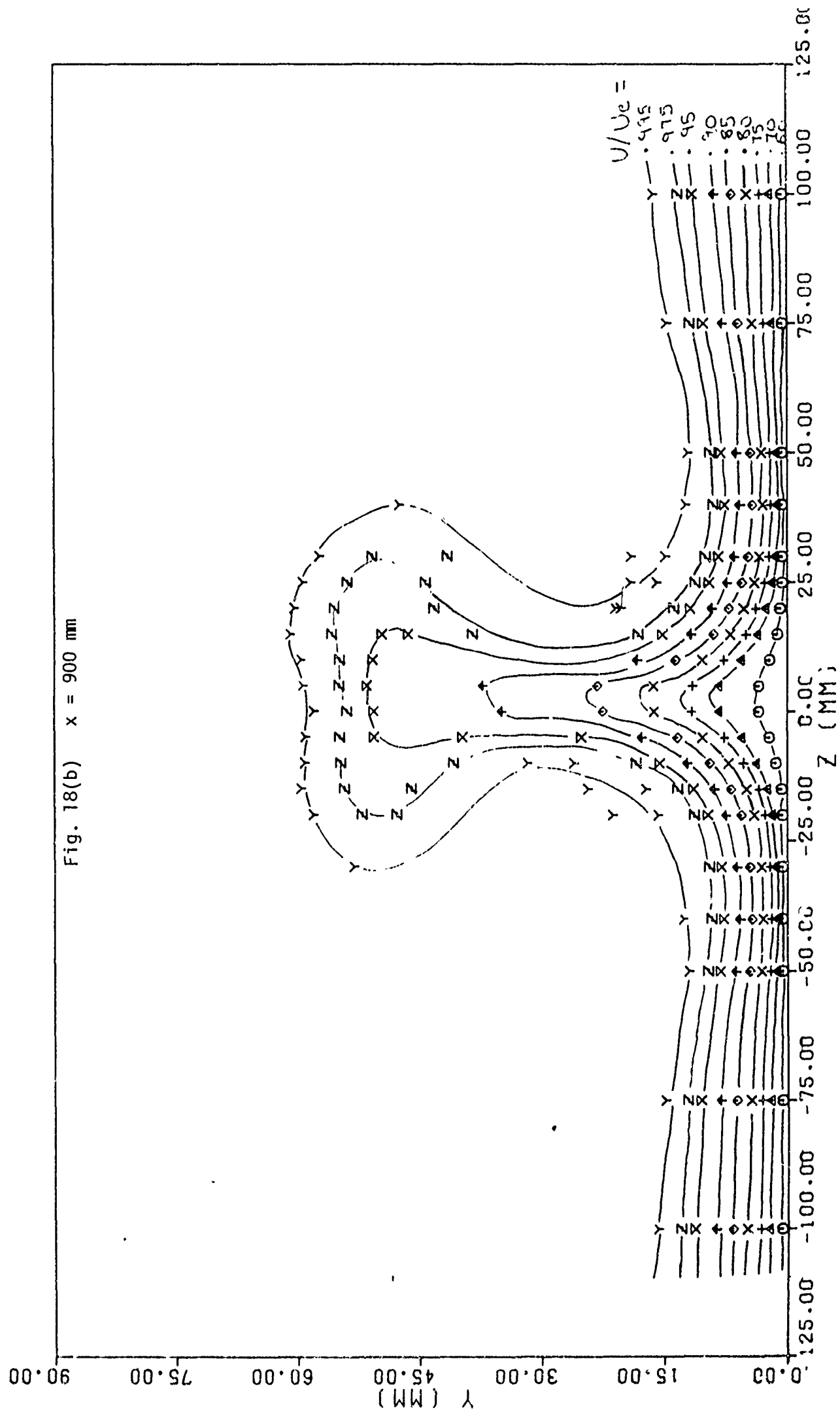


Fig. 18 Velocity contours in double vortex, "common flow" upwards

Fig. 18(a)  $x = 600$  mm

○	U/UE = .60	↑	U/UE = .90
△	U/UE = .70	×	U/UE = .85
+	U/UE = .75	Z	U/UE = .975
×	U/UE = .80	Y	U/UE = .995
◇	U/UE = .85		





Y (mm)  
90.00  
75.00  
60.00  
45.00  
30.00  
15.00  
0.00

○	U/UE = .60	+	U/UE = .90
△	U/UE = .70	x	U/UE = .95
+	U/UE = .75	Z	U/UE = .975
x	U/UE = .80	Y	U/UE = .995
◇	U/UE = .85		

Fig. 18(c) x = 1350 mm

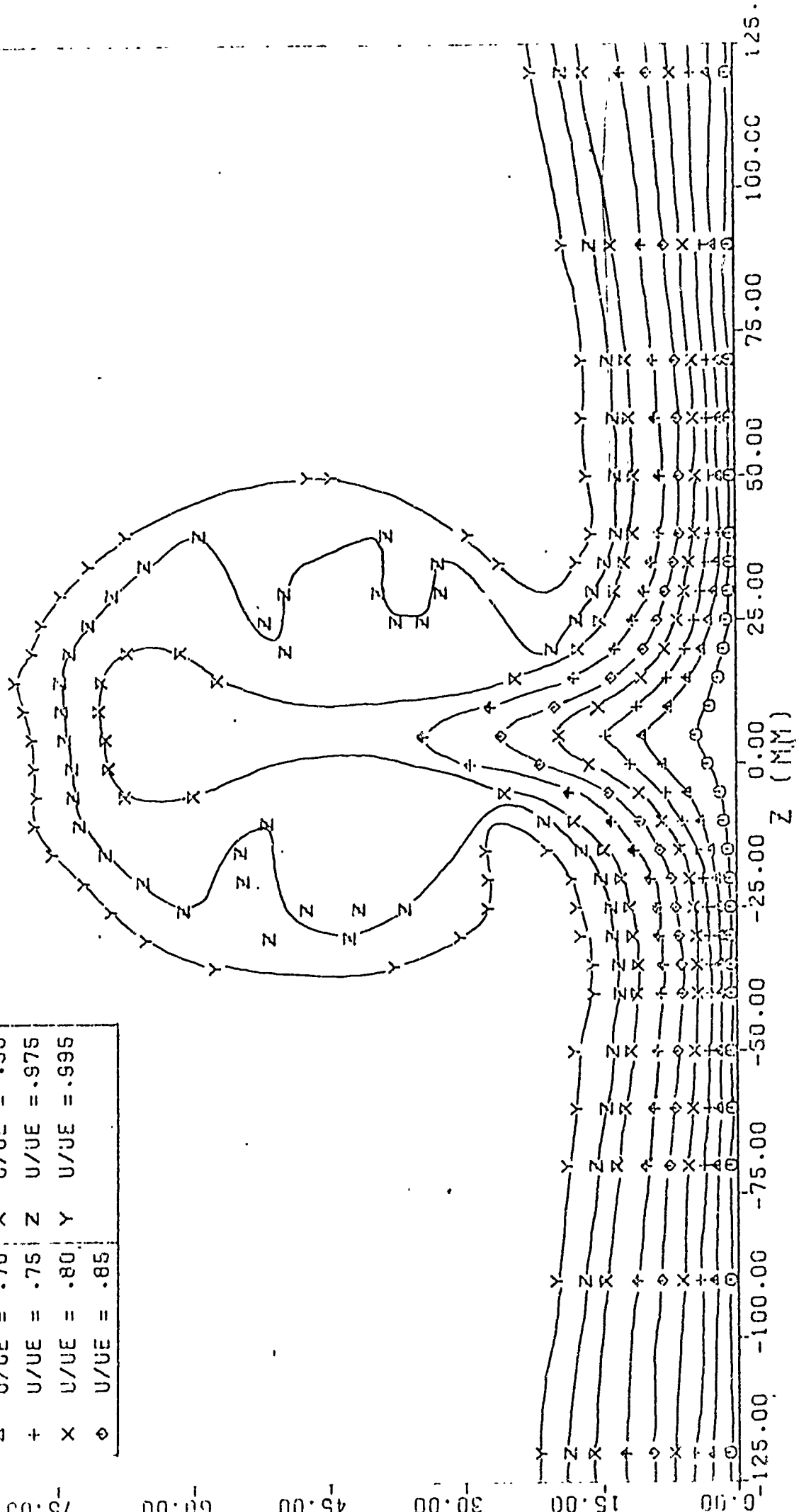
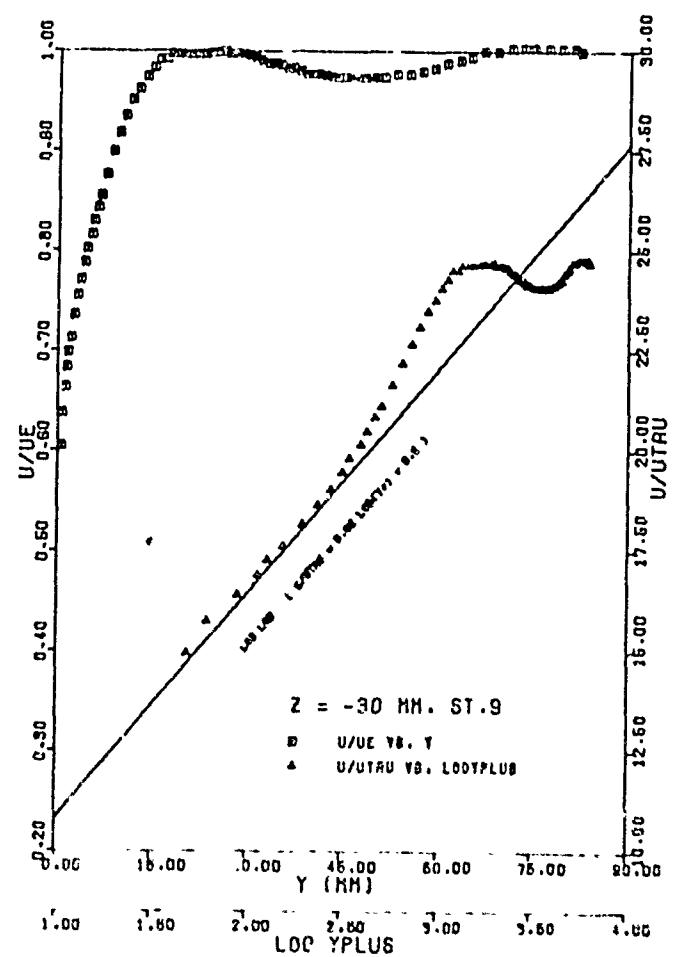
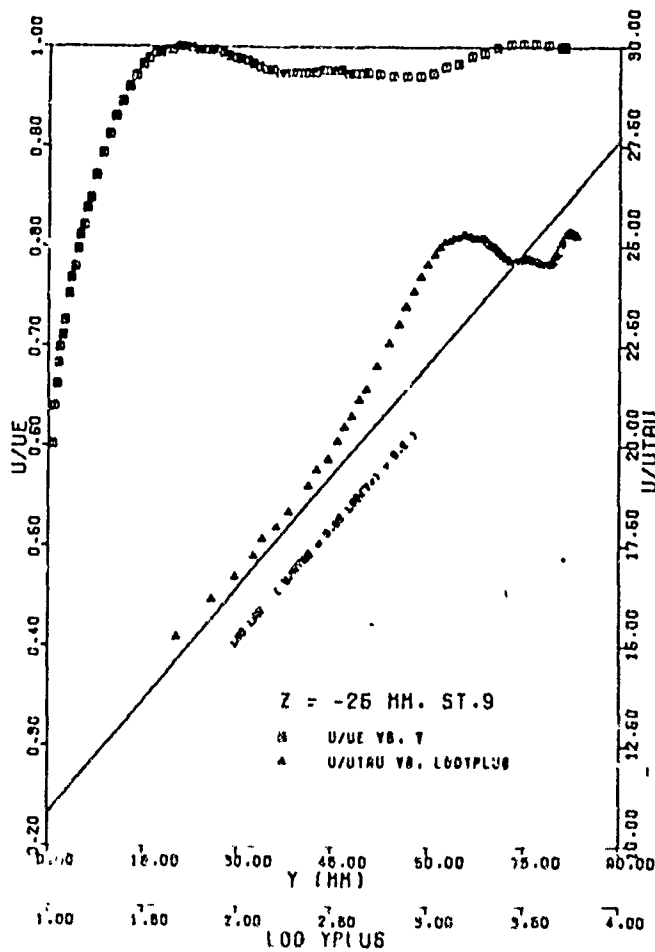
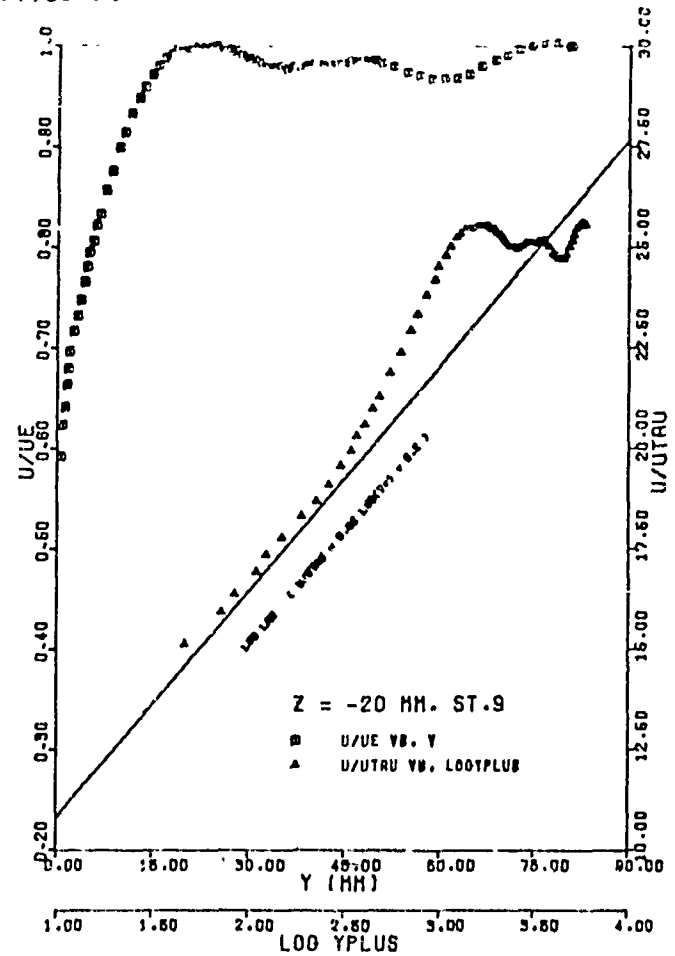
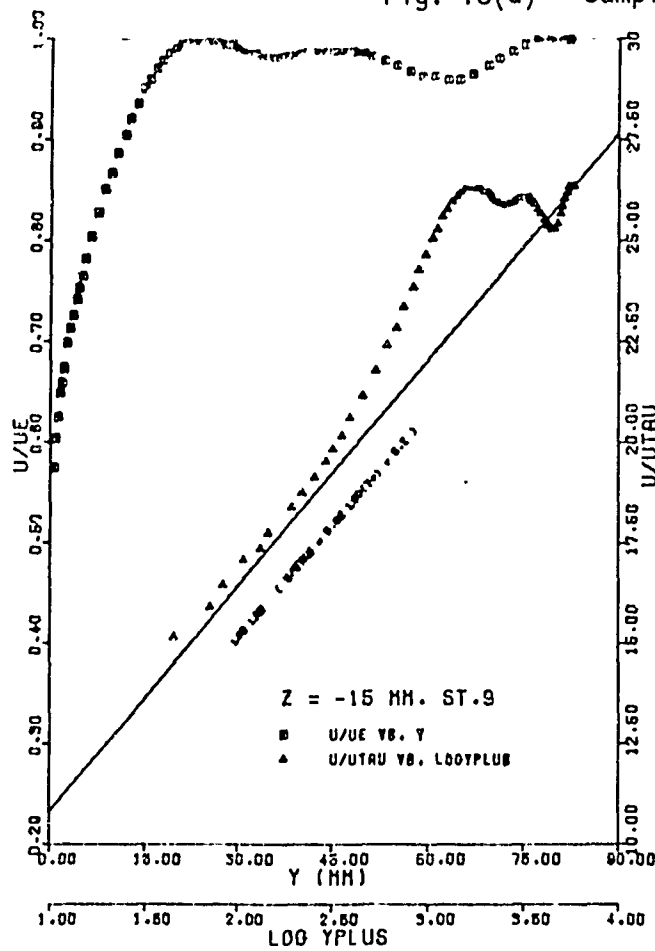
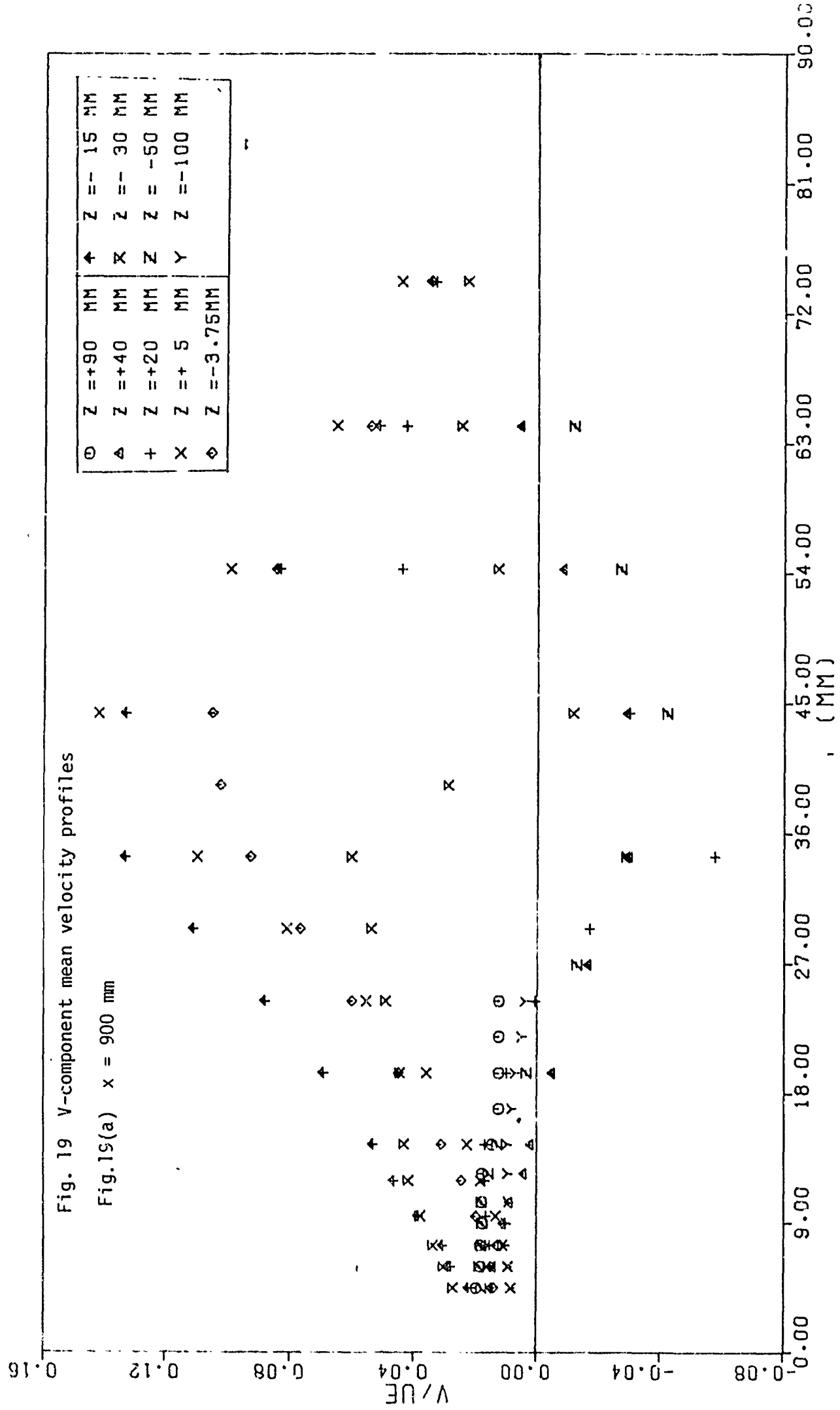


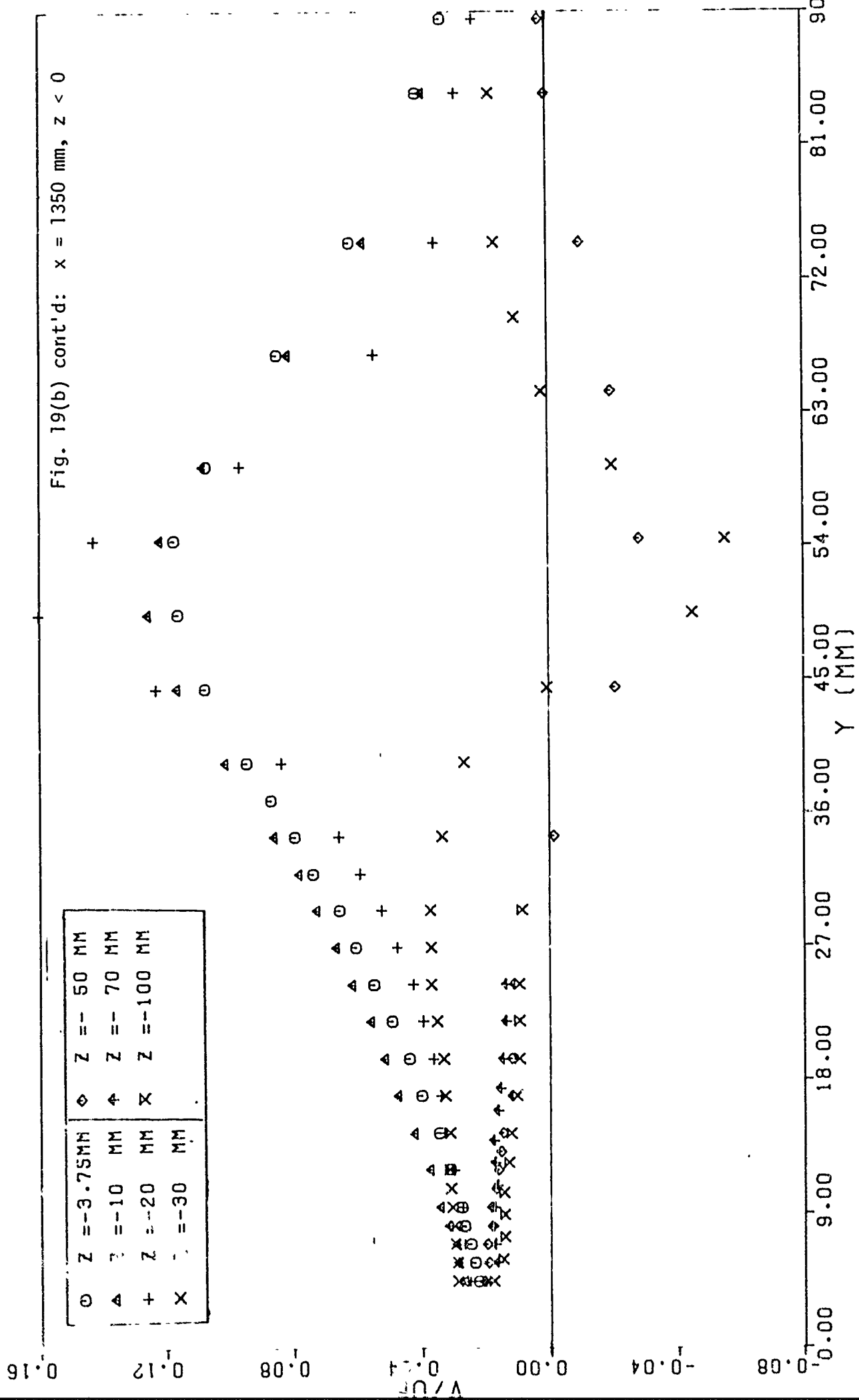
Fig. 18(d) Sample profiles at  $x = 1350$  mm

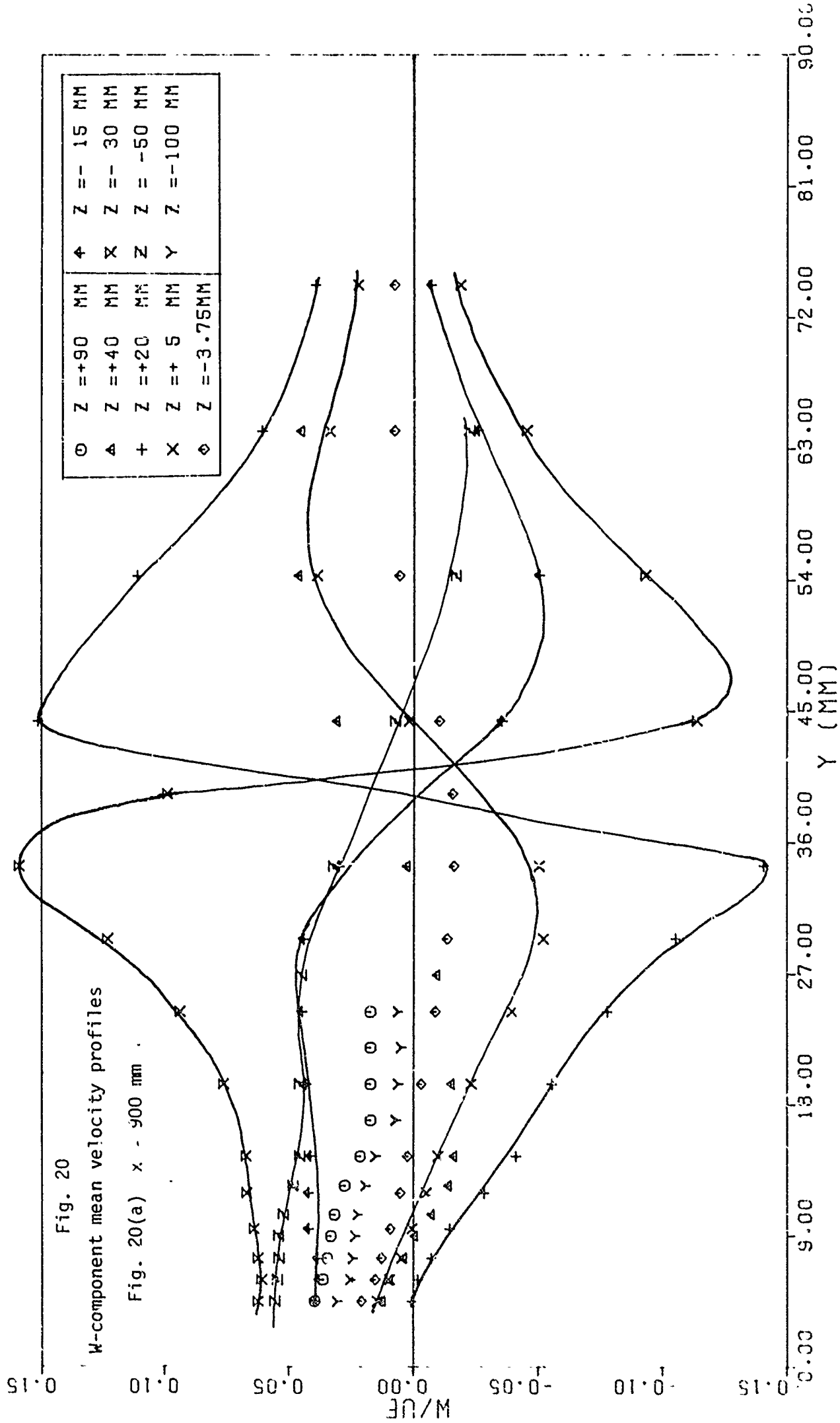


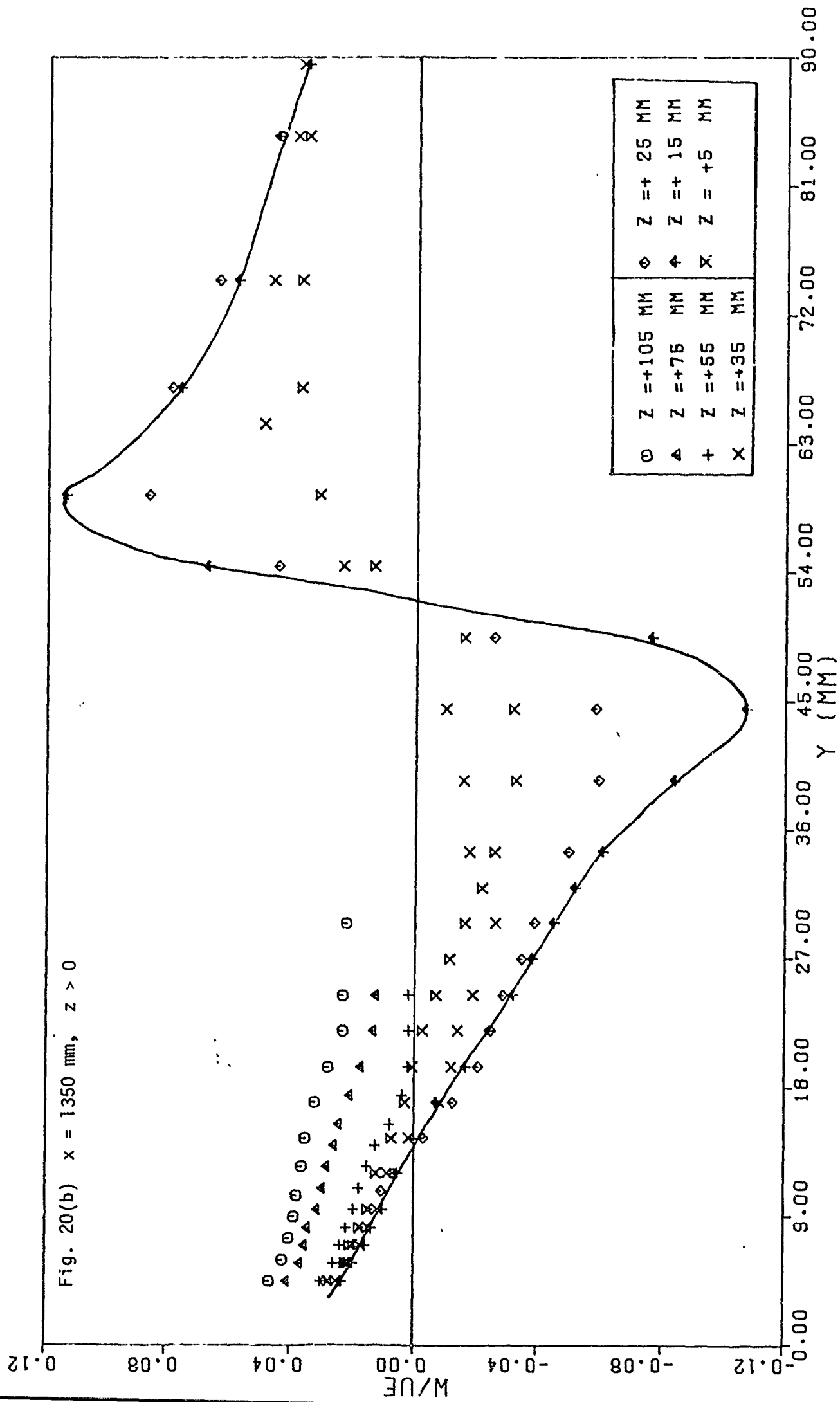


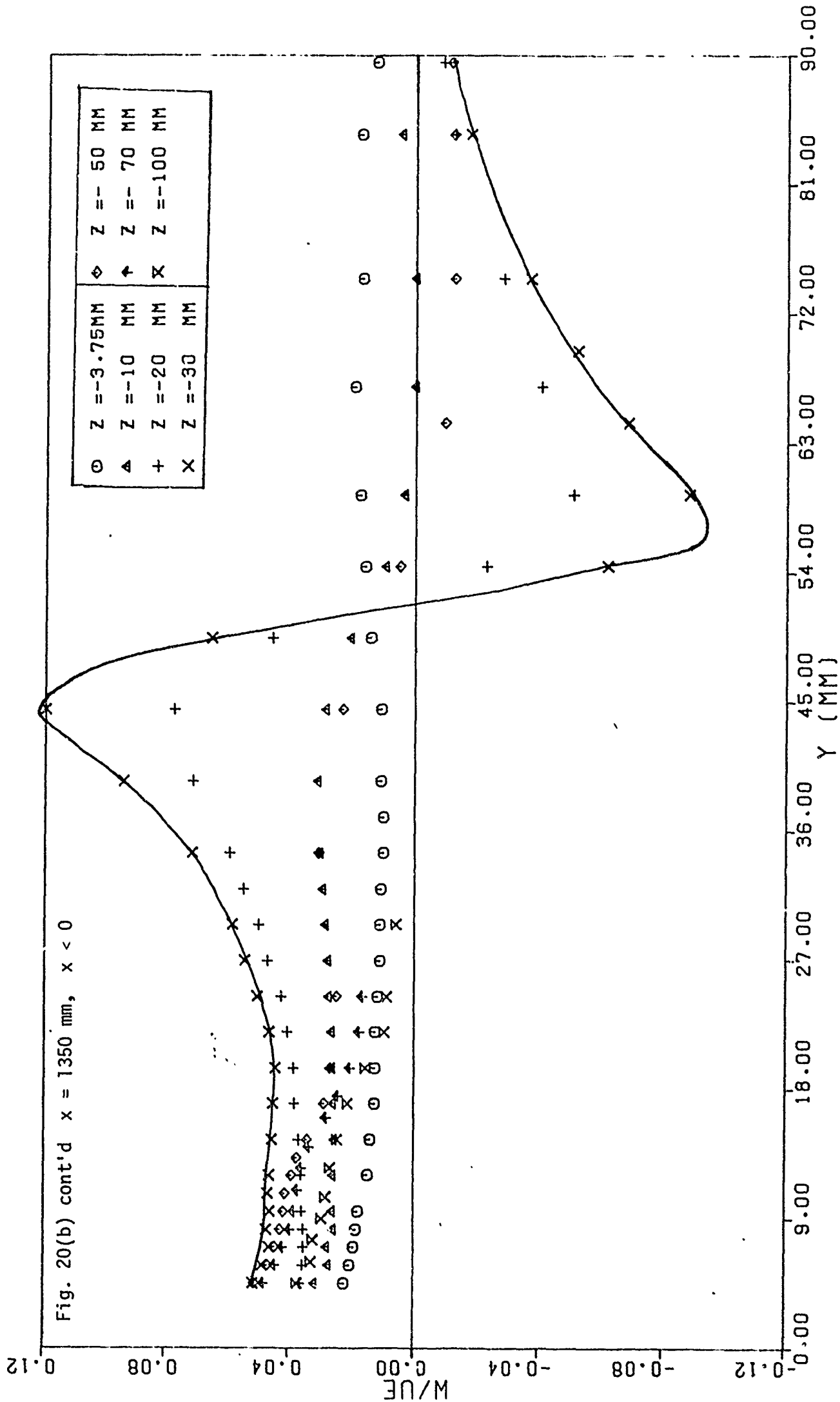


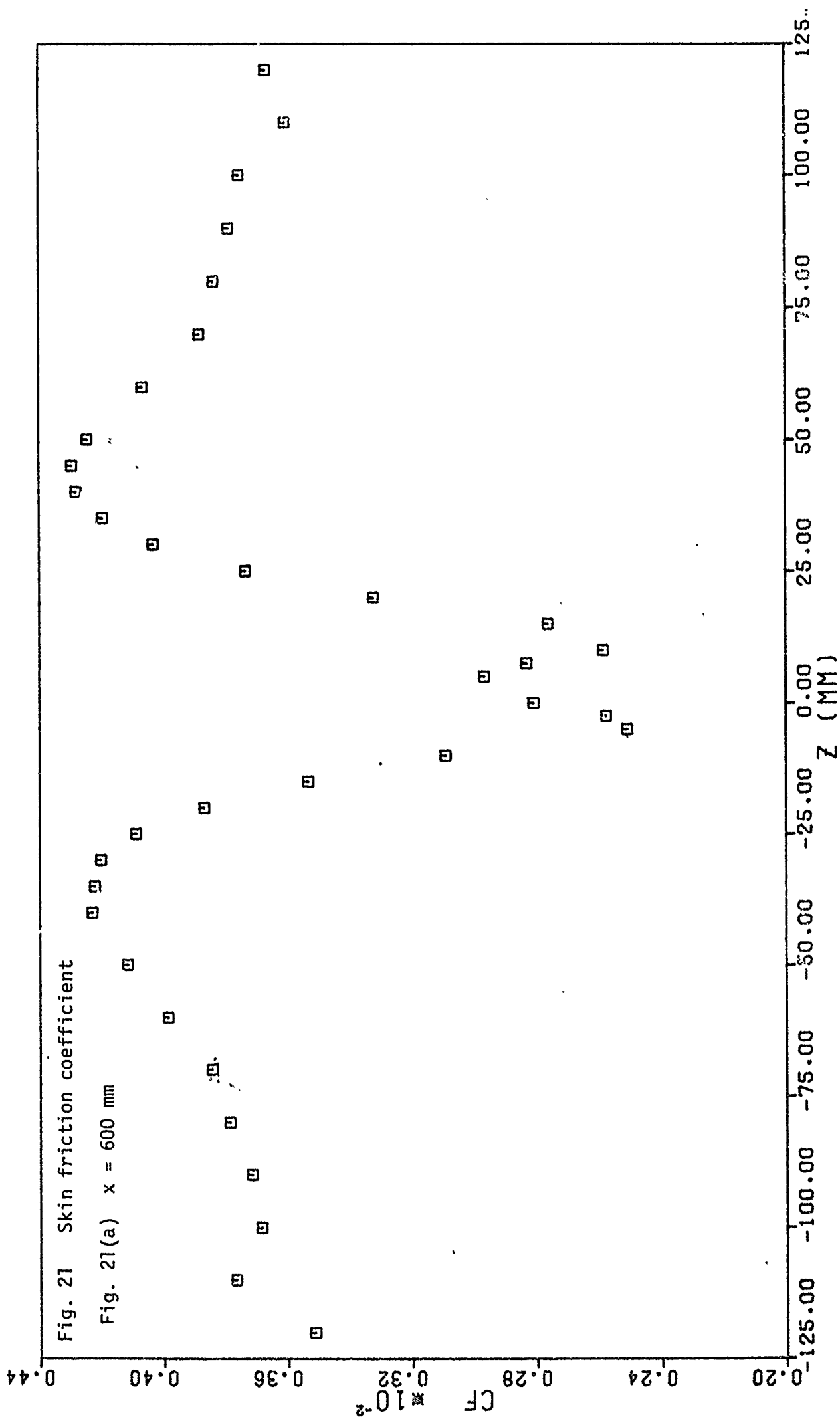


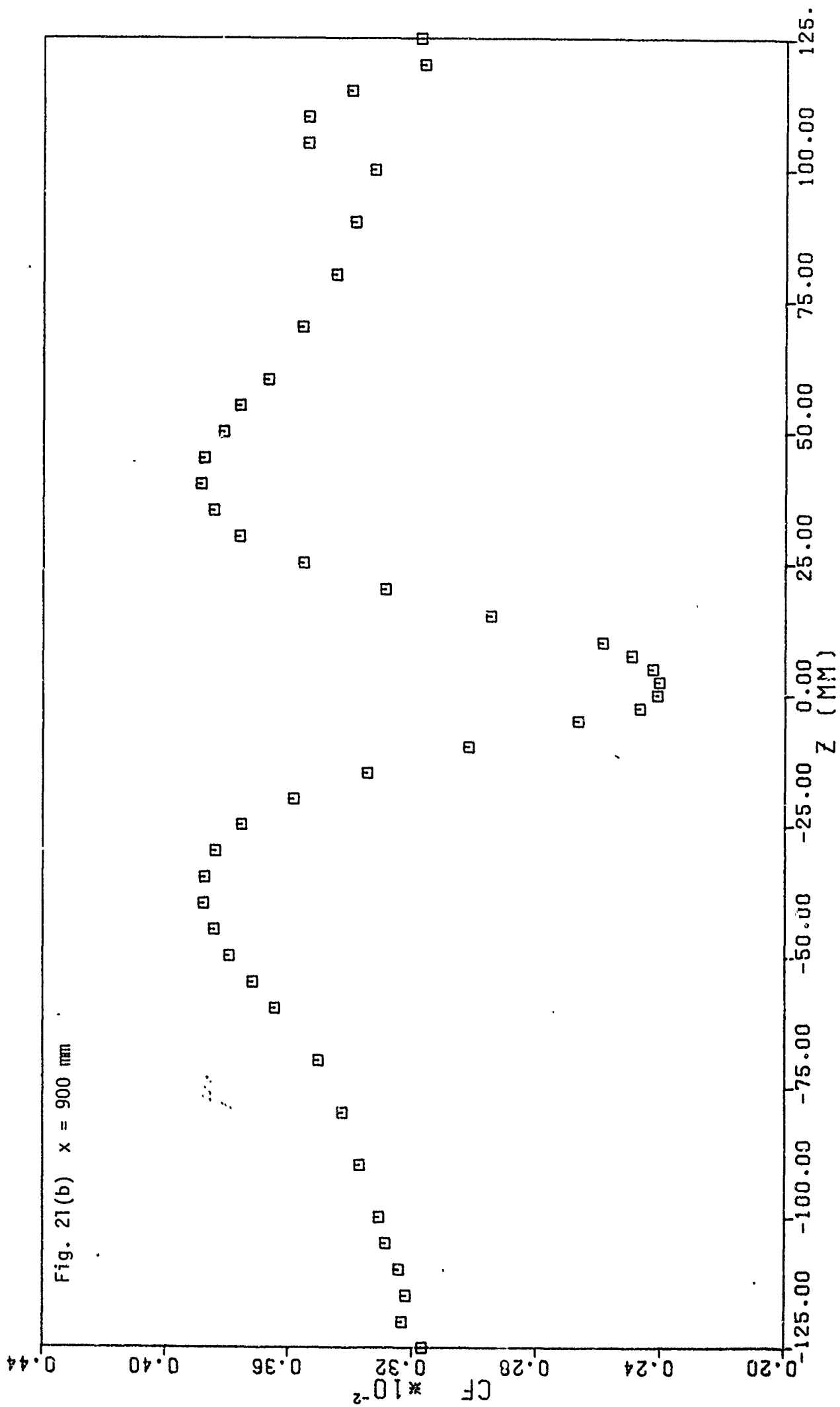


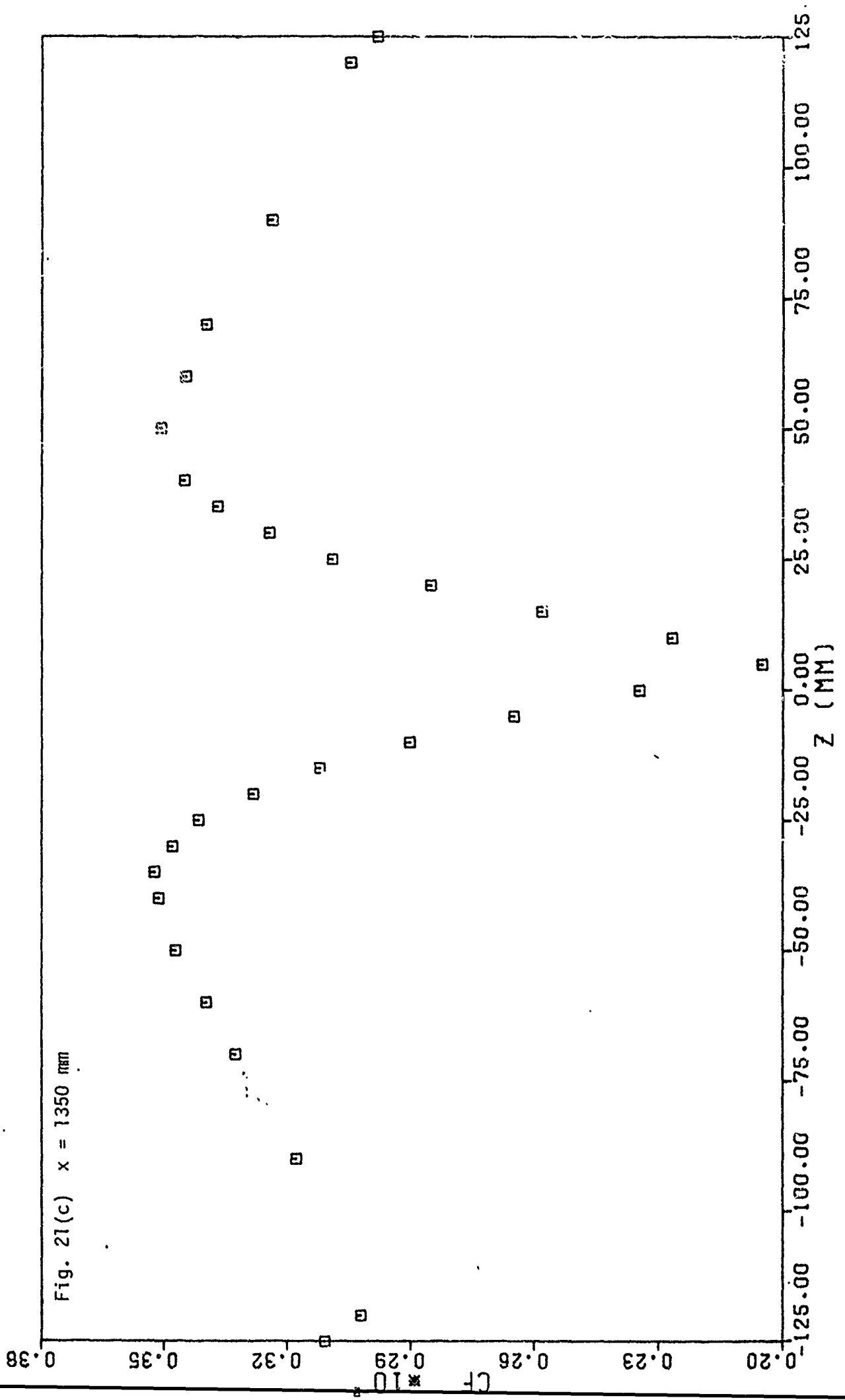




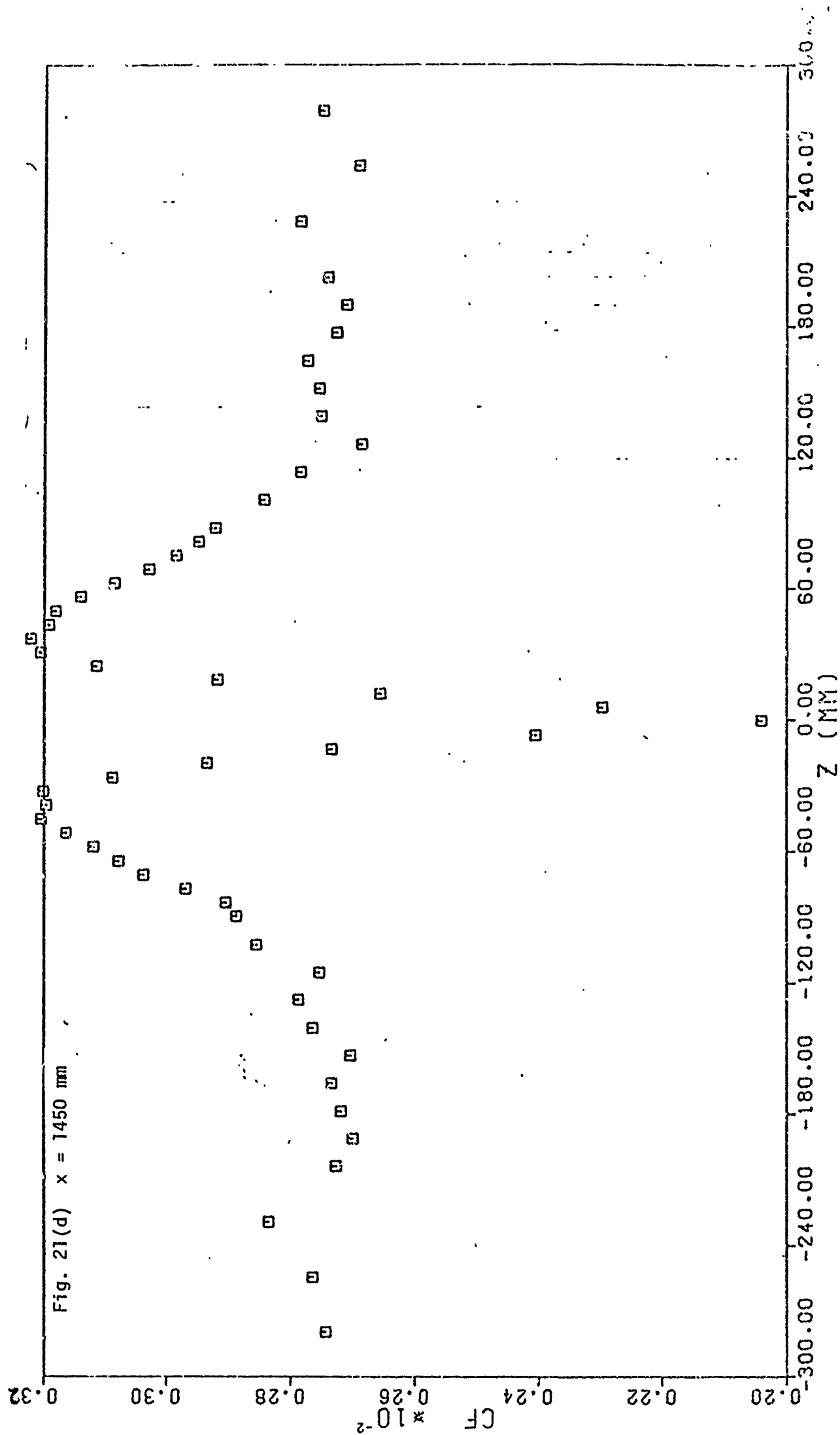












90.00

75.00

60.00

45.00

30.00

15.00

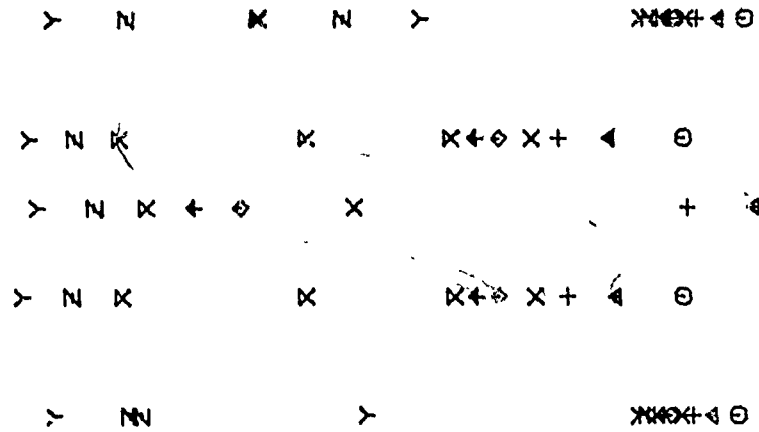
0.00

Y (MM)

Fig. 22 Contours of  $\overline{u_i u_j} / U_e^2$ ,  $x = 900$  mm

Fig. 22(a)  $\overline{u^2}$

○	USQ = .004	◇	USQ = .001
▲	USQ = .003	†	USQ = .0008
+	USQ = .002	×	USQ = .0006
×	USQ = .0015	z	USQ = .0004
		Y	USQ = .0002



125.00

100.00

75.00

50.00

25.00

0.00

-25.00

-50.00

-75.00

-100.00

-125.00

Z (MM)

Y X + 4 0

0 Y X X

Y X + 4 0

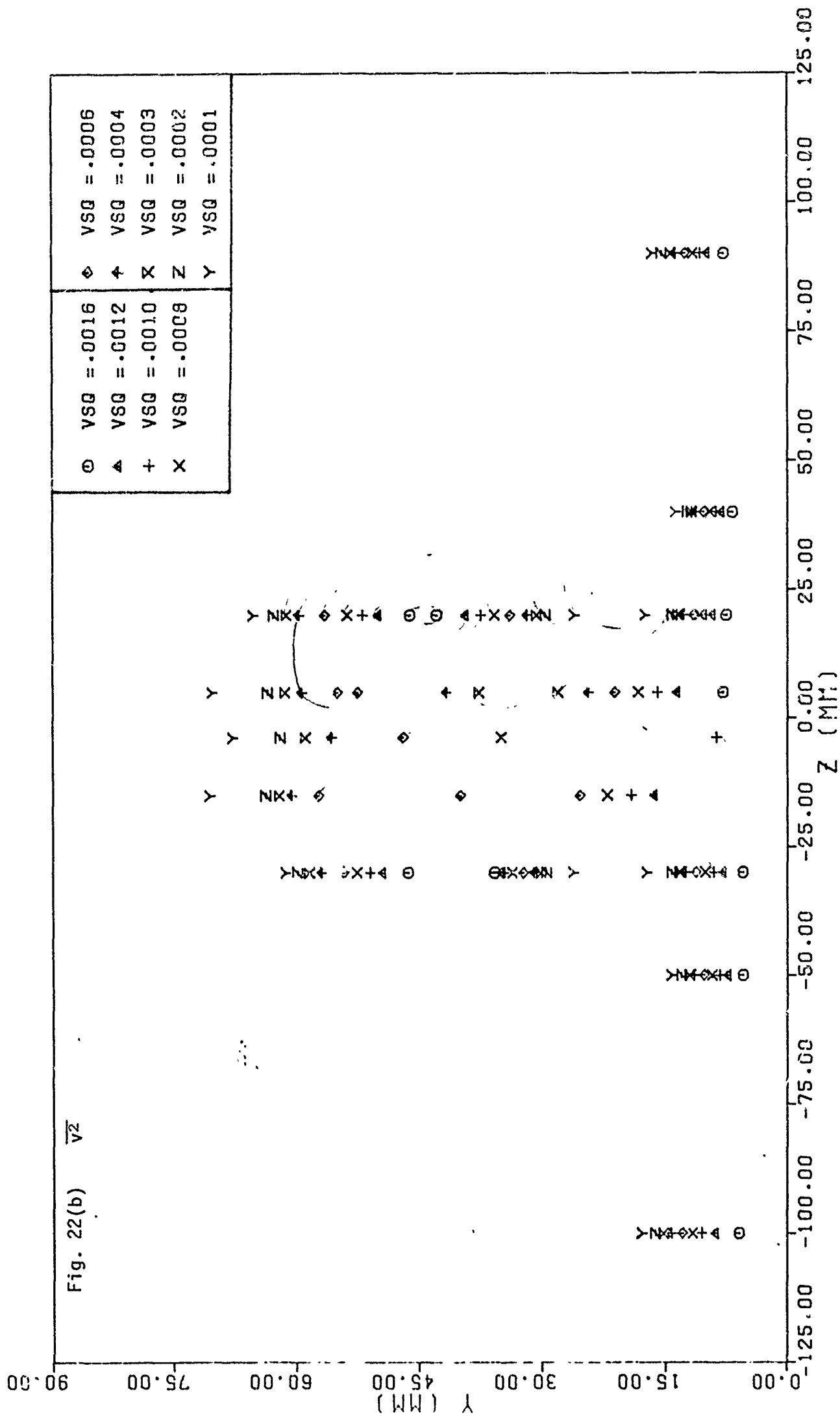
0 + 4

0 + 4

0 Y X X

0 Y X X

0 Y X X



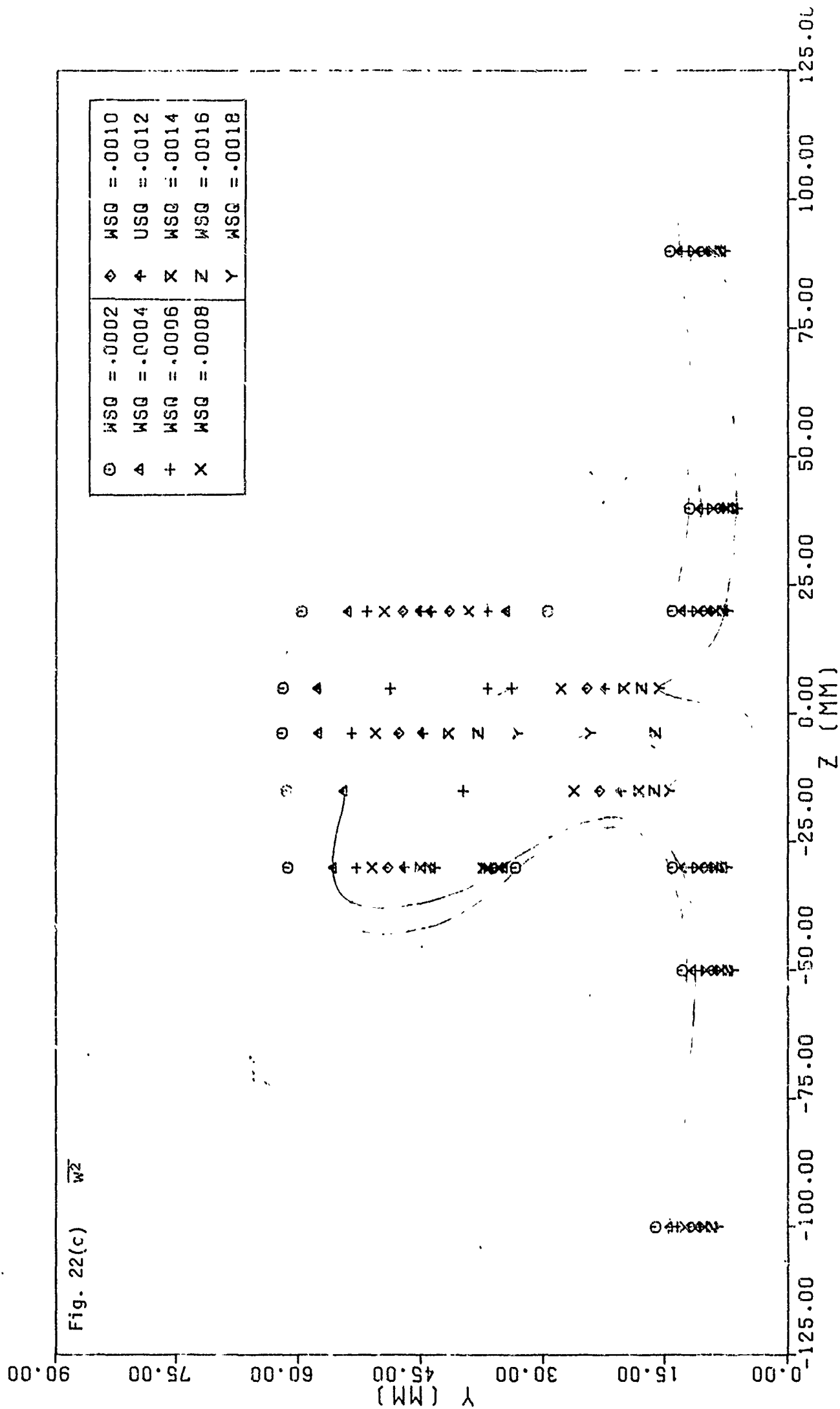
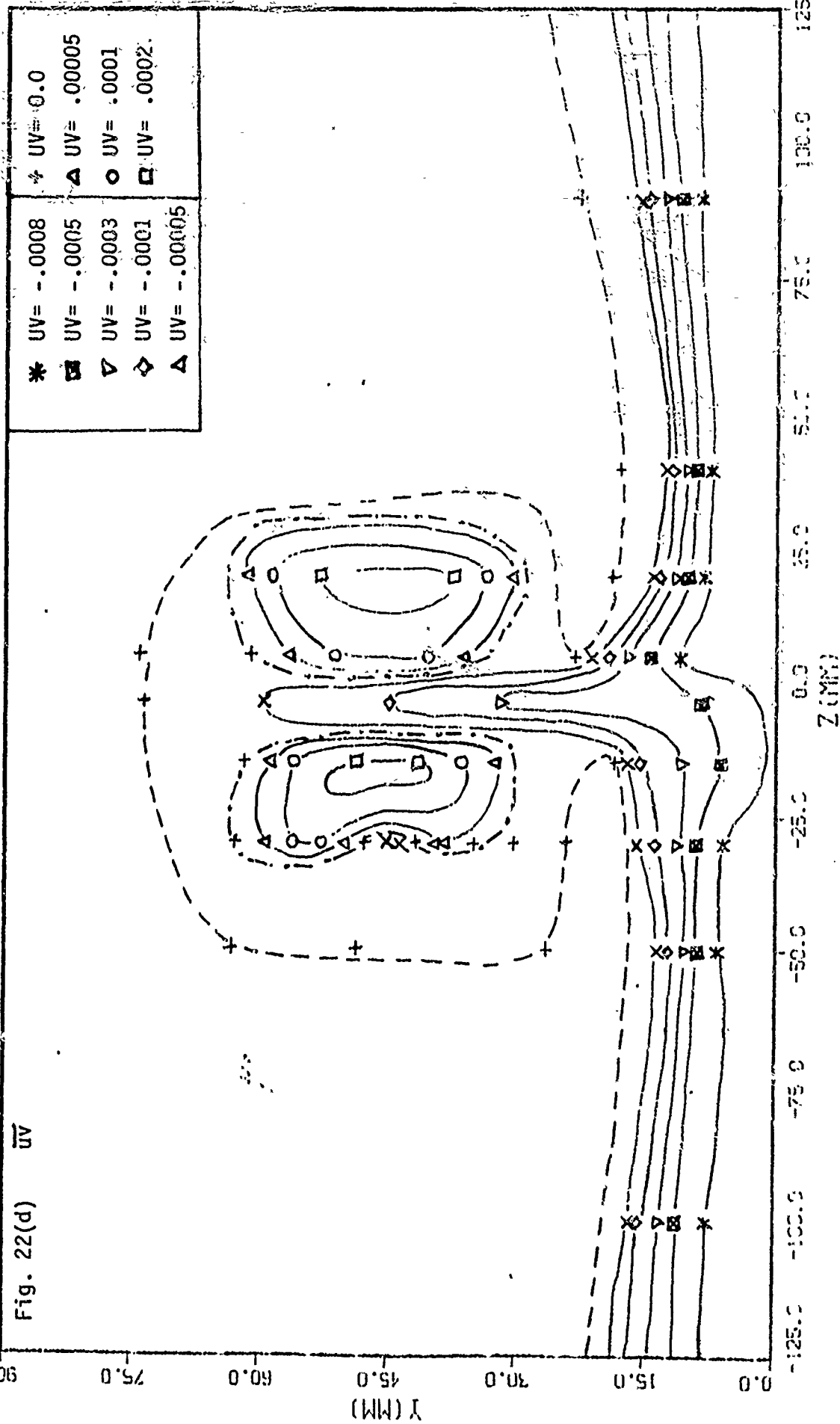


Fig. 22(d)  $\overline{uv}$



90.00

75.00

60.00

45.00

30.00

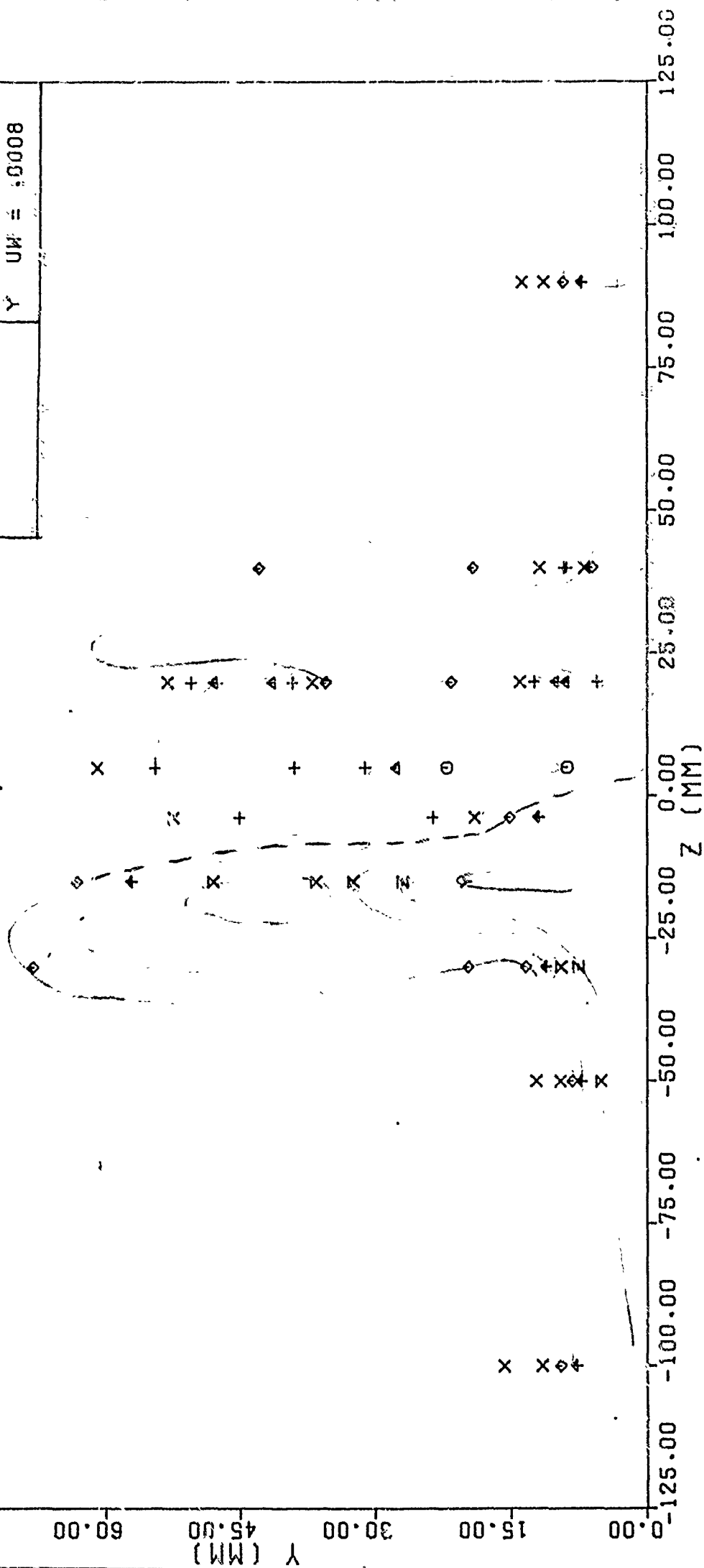
15.00

0.00

Fig. 22(e)

$\overline{uw}$

$\ominus$	$uw = -.0008$	$\diamond$	$uw = 0.0$
$\Delta$	$uw = -.0004$	$\nabla$	$uw = .0001$
$+$	$uw = -.00025$	$\times$	$uw = .00025$
$\times$	$uw = -.0001$	$\square$	$uw = .0004$
		$\gamma$	$uw = .0008$

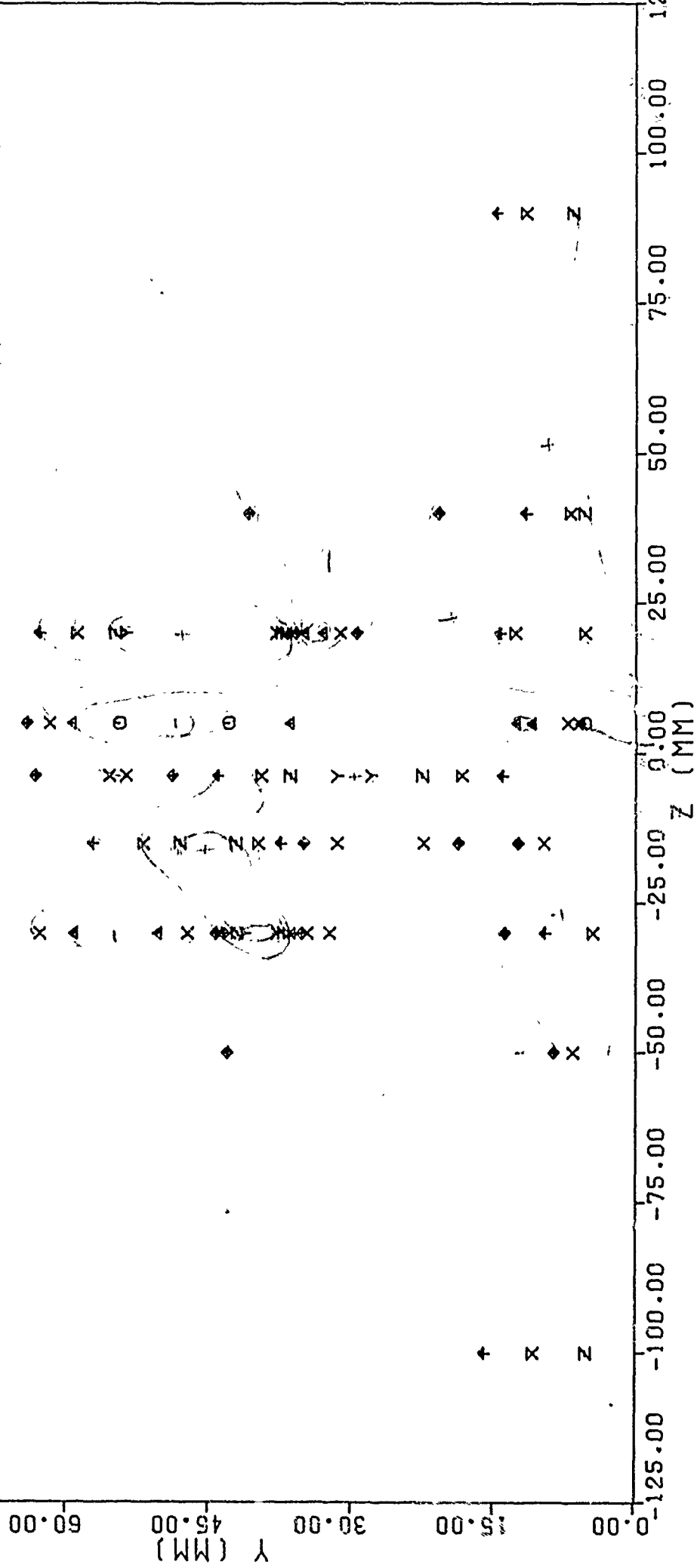


90.00

Fig. 22(f)

$\overline{VW}$

○	VW = -.0002	◇	VW = .00005
△	VW = -.0001	+	VW = .00010
+	VW = -.00005	X	VW = .00015
X	VW = 0.0	Z	VW = .0002
		Y	VW = .00025



0.00

15.00

30.00

45.00

60.00

75.00

90.00

-125.00

-100.00

-75.00

-50.00

-25.00

0.00

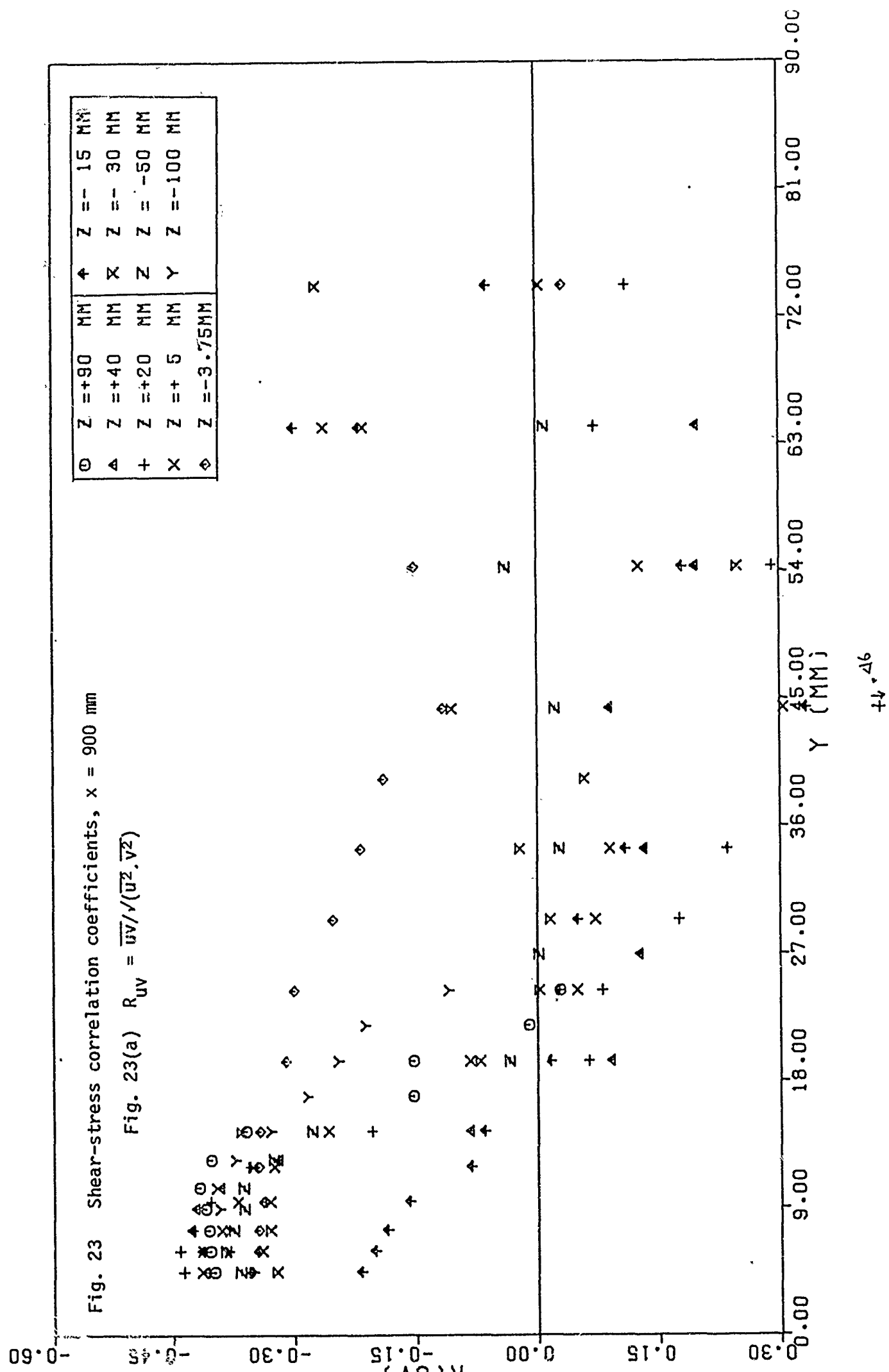
25.00

50.00

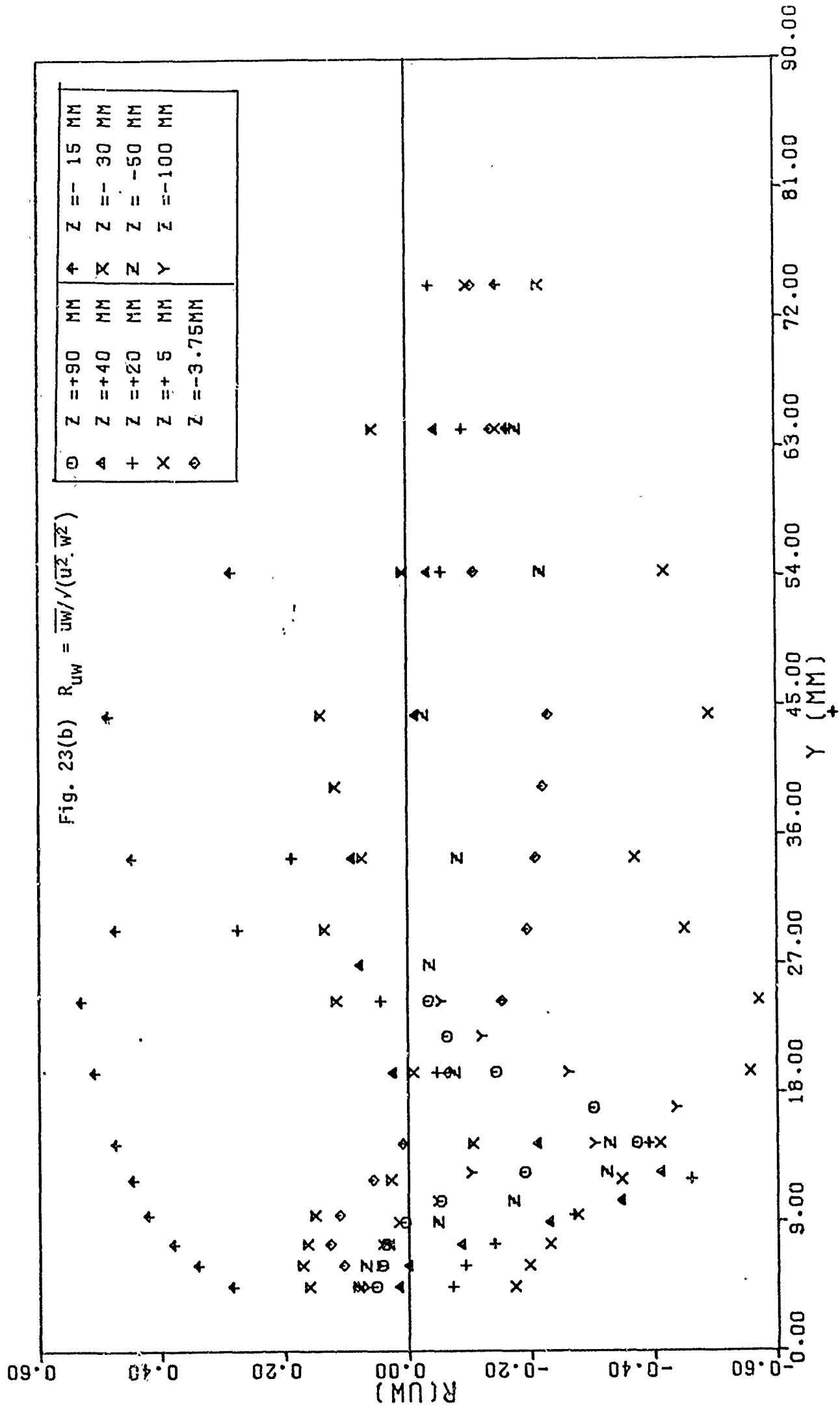
75.00

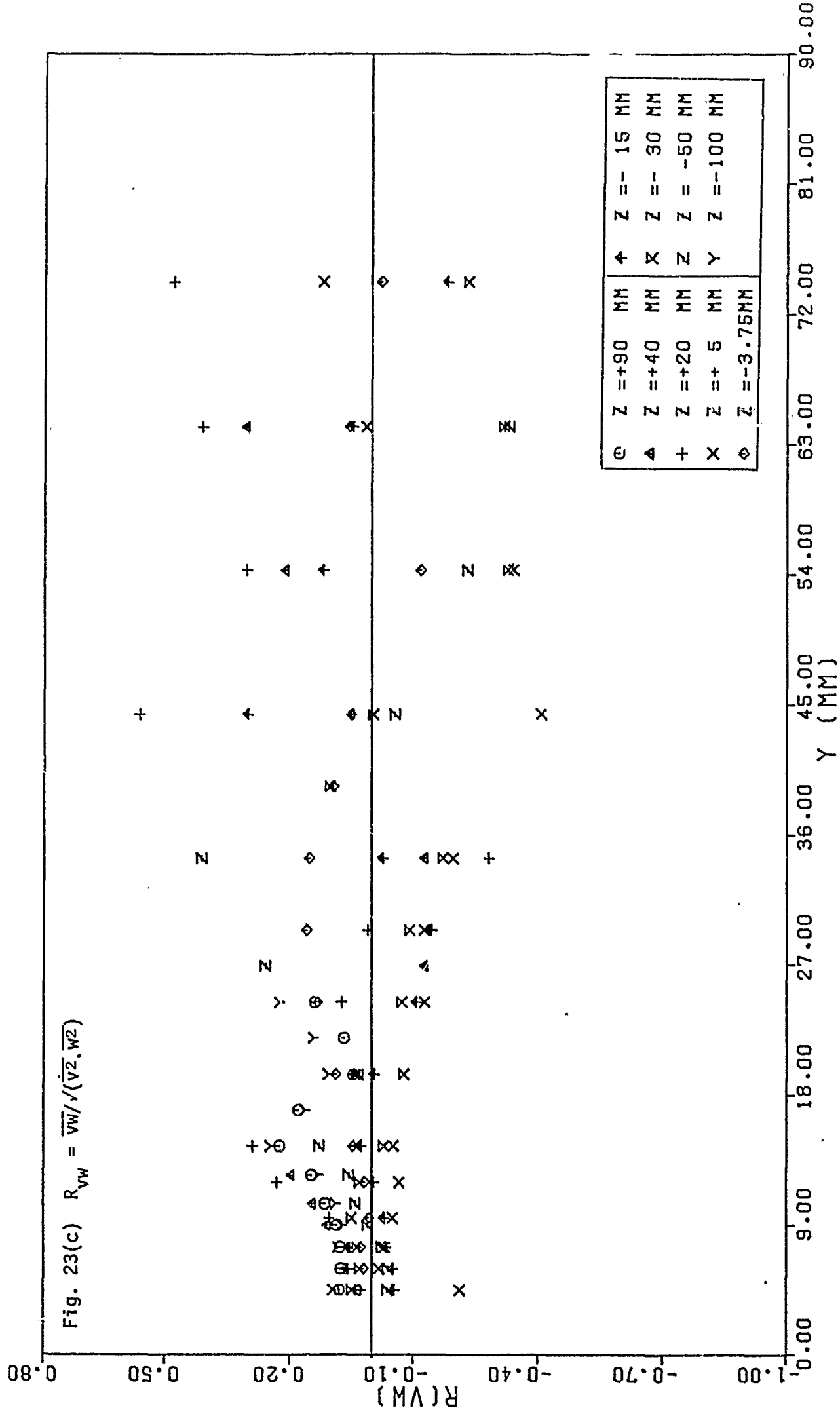
100.00

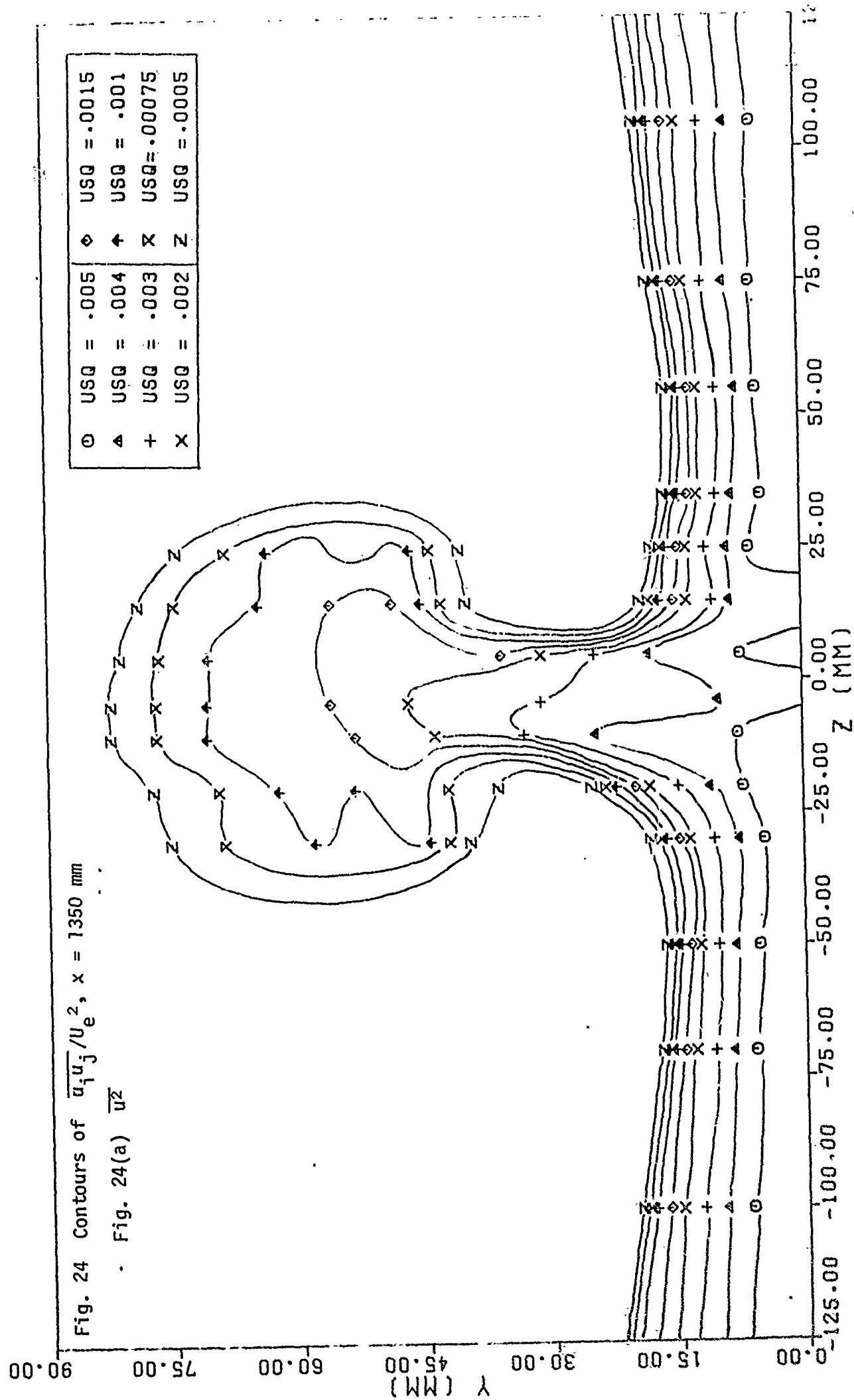
125.00

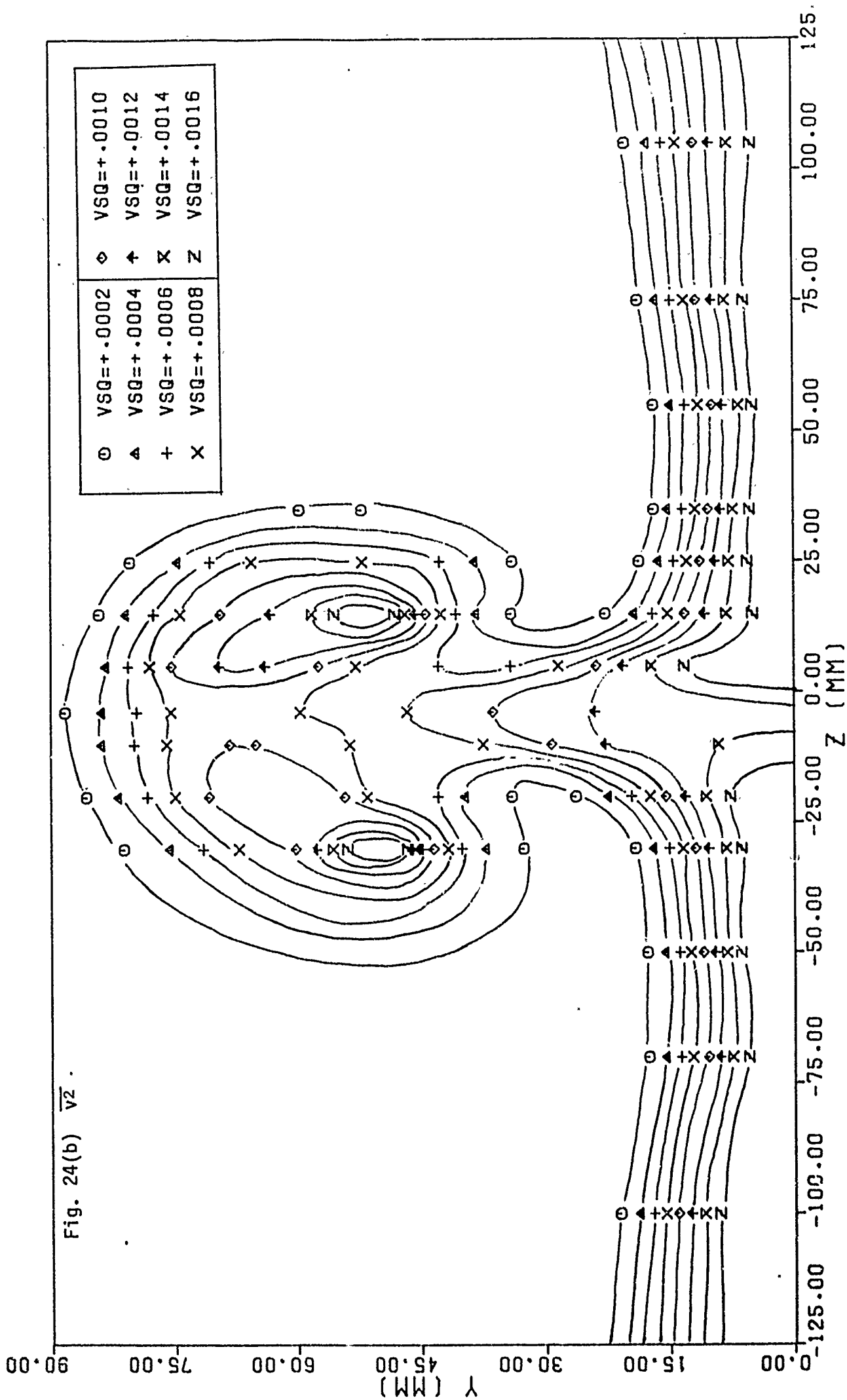


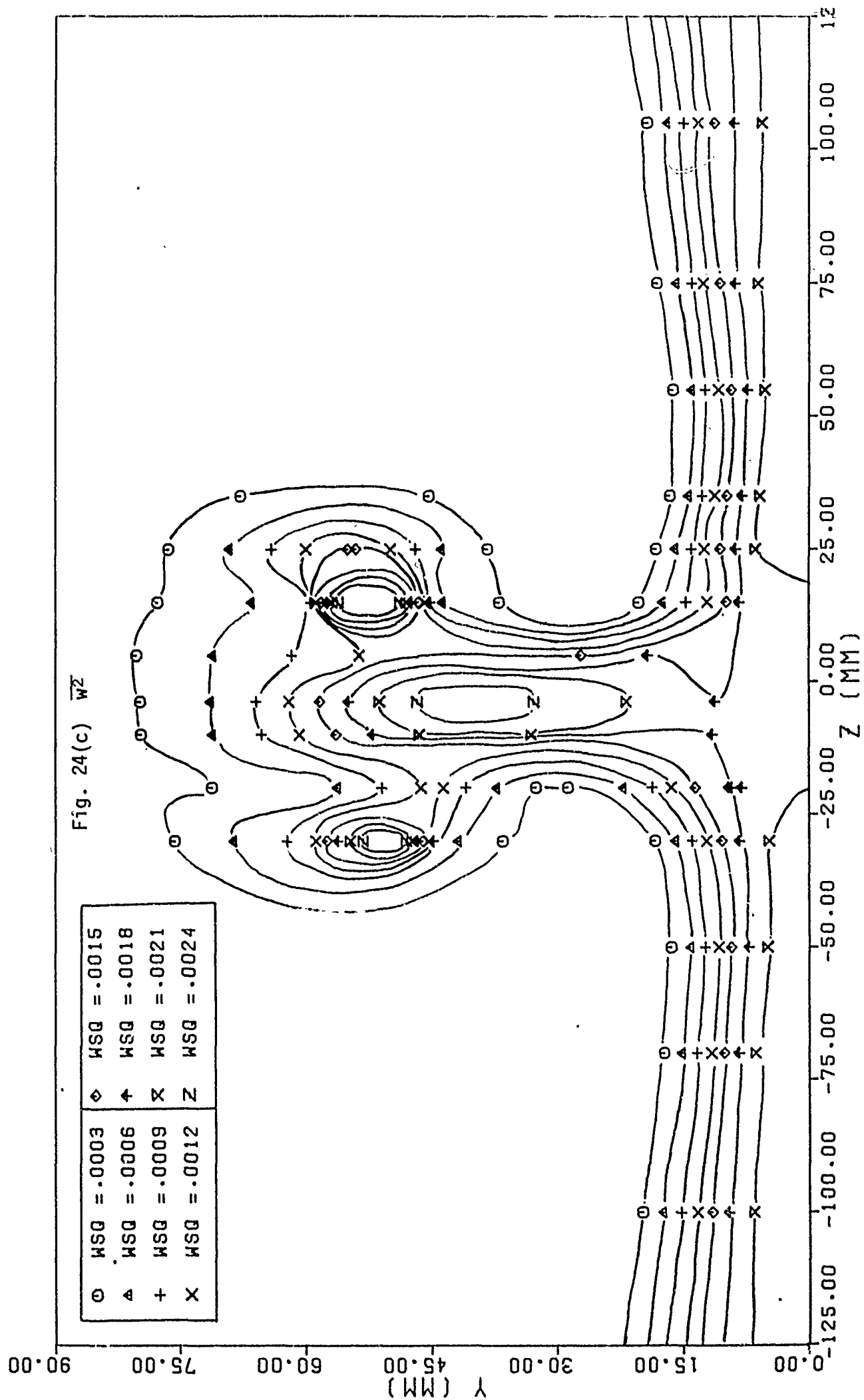












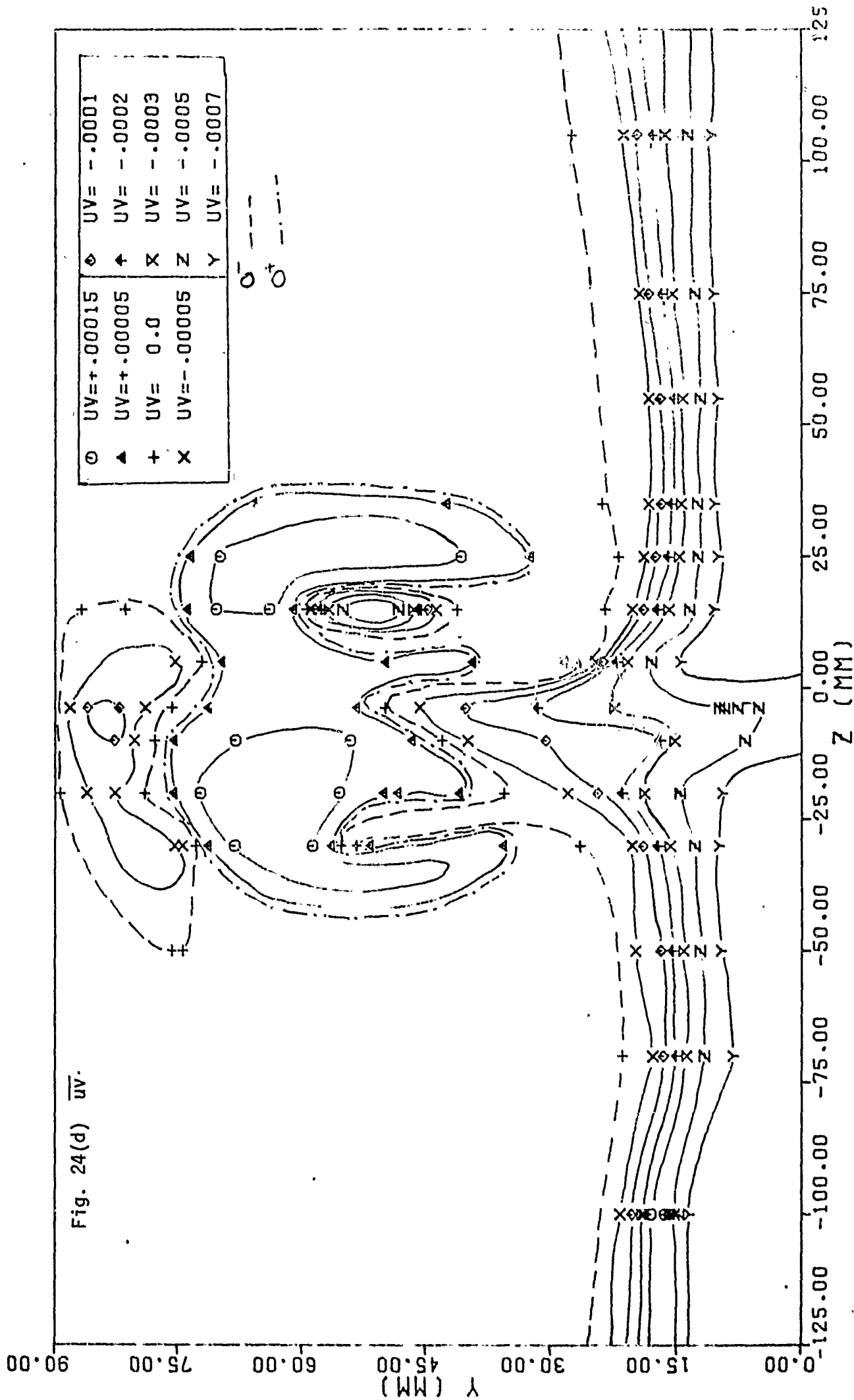
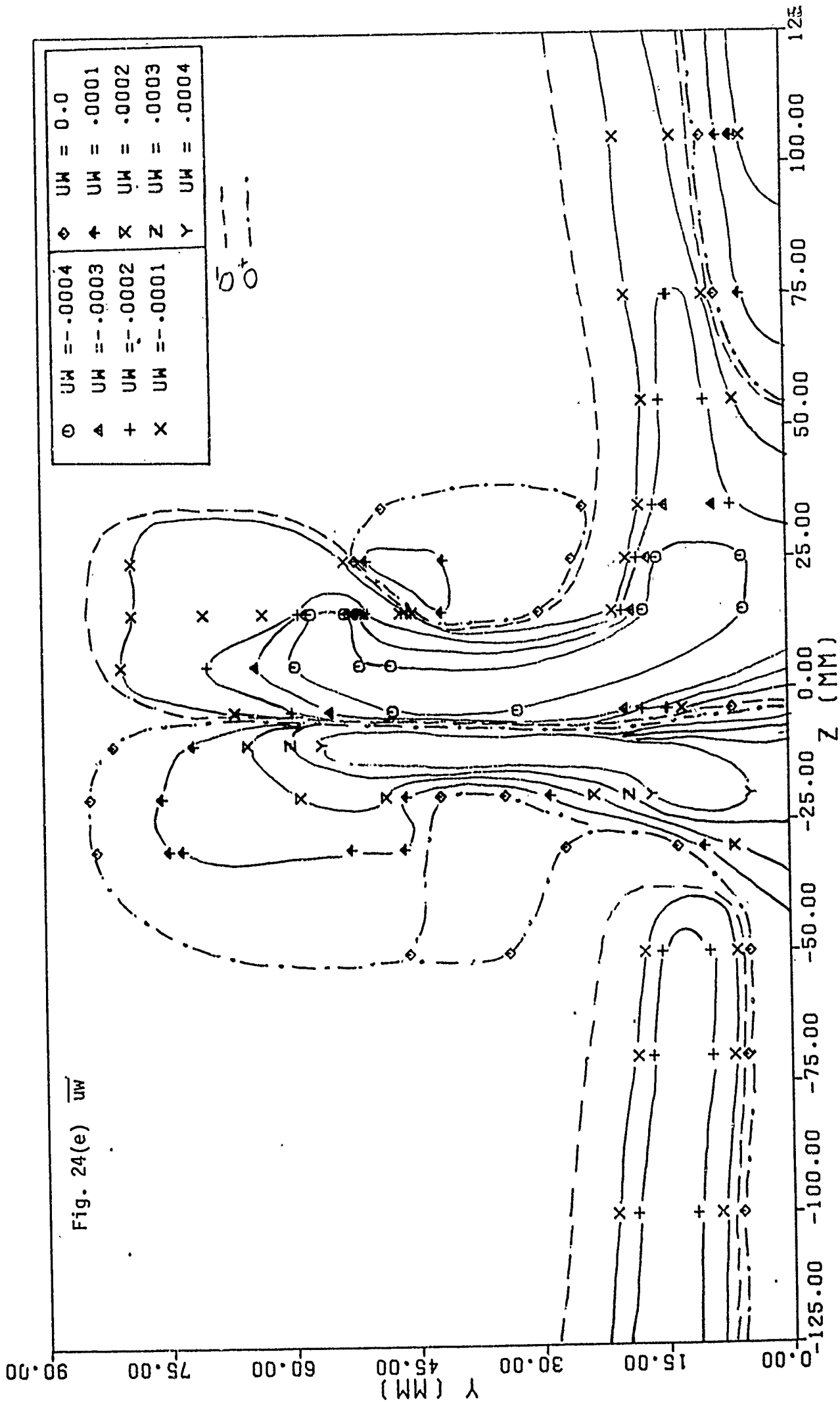
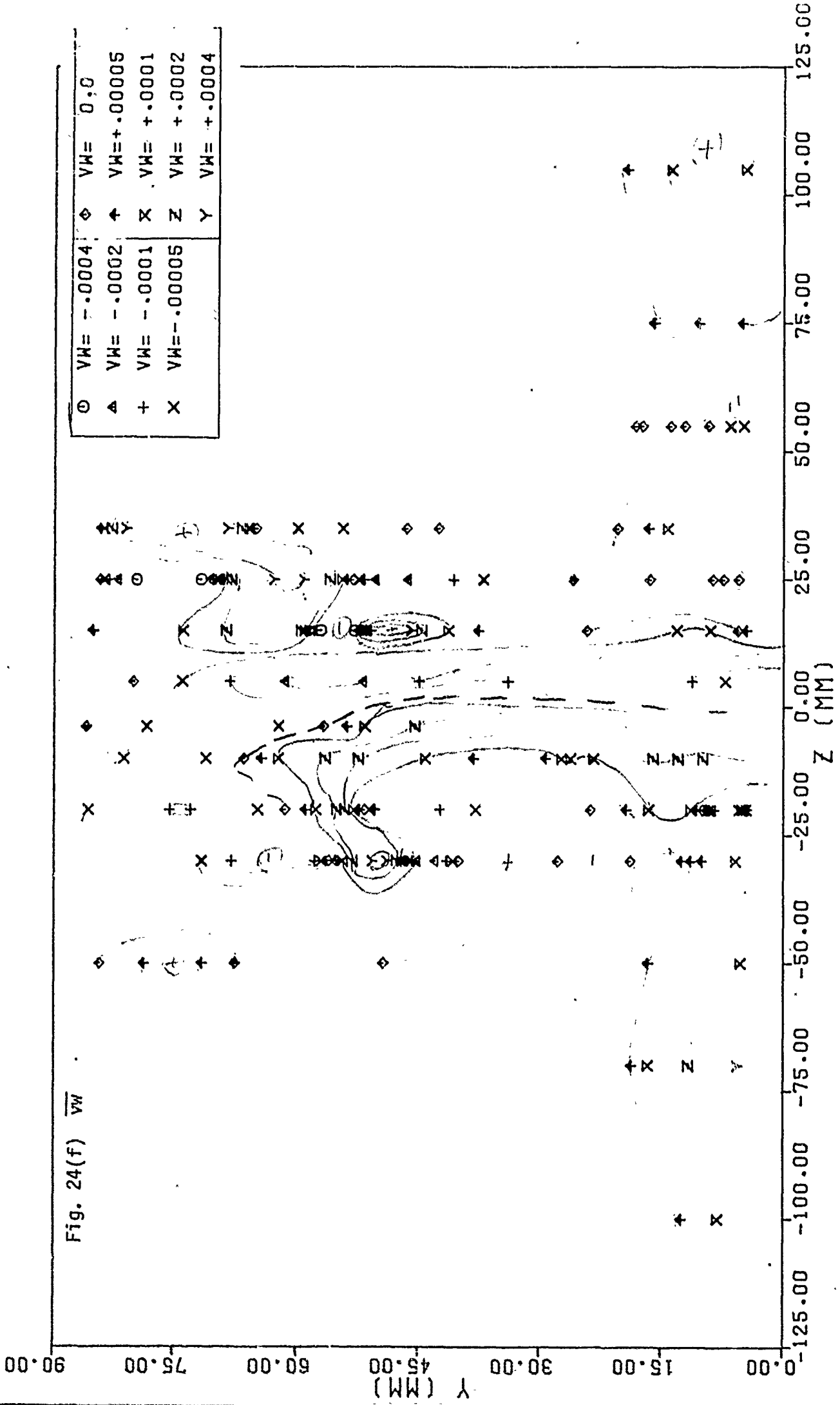


Fig. 24(e)  $\overline{uw}$





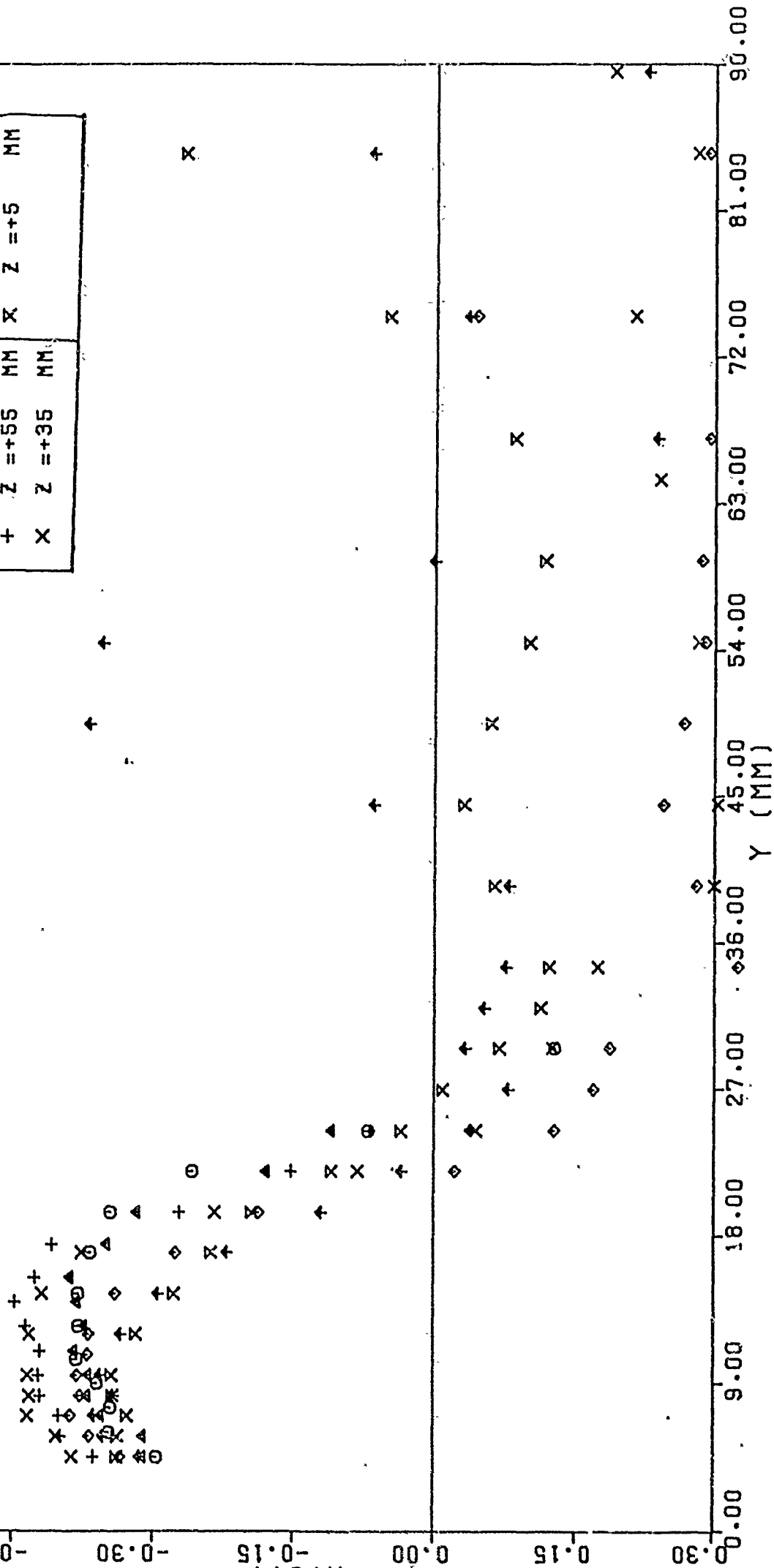


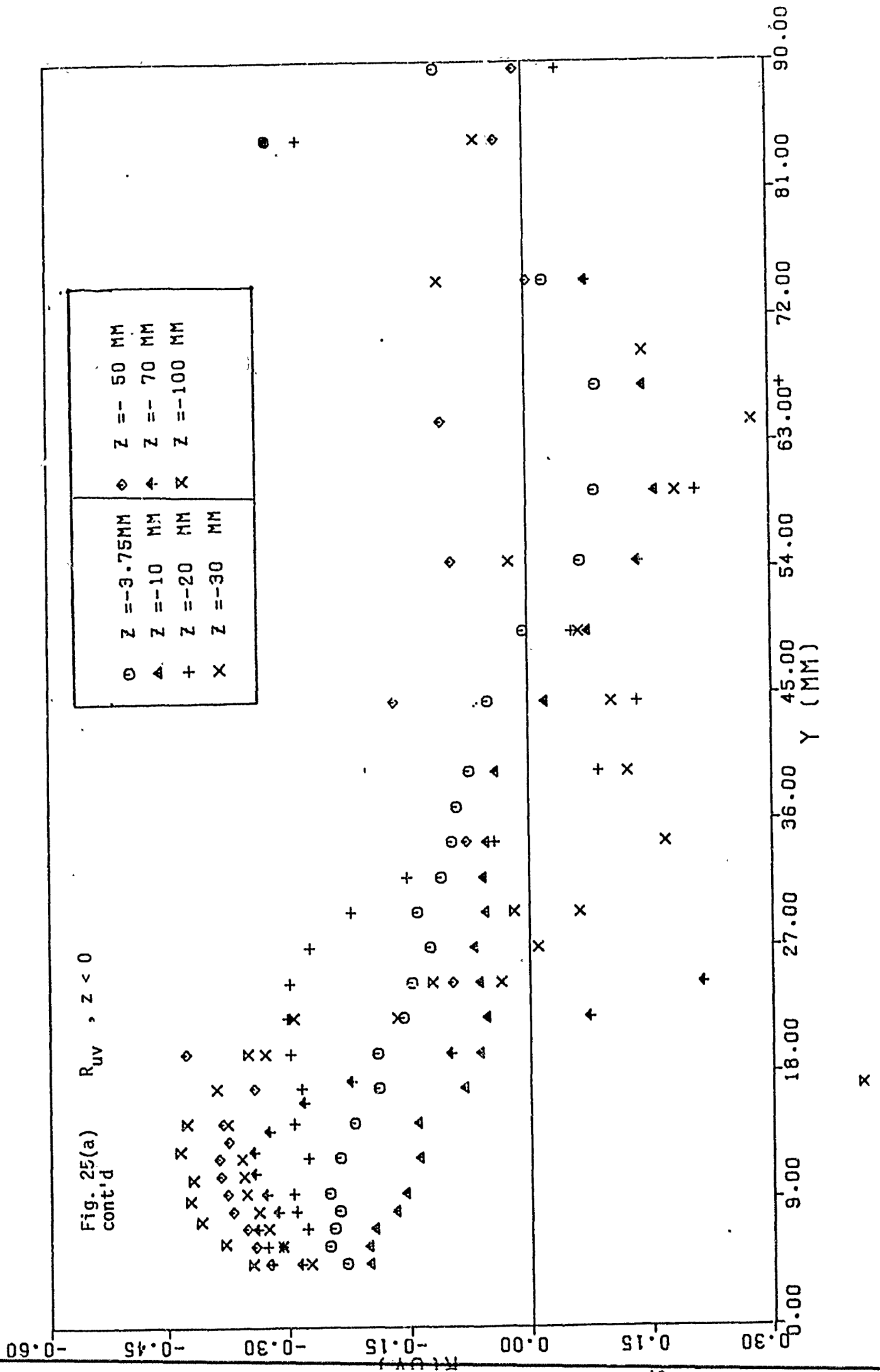
R(UV)

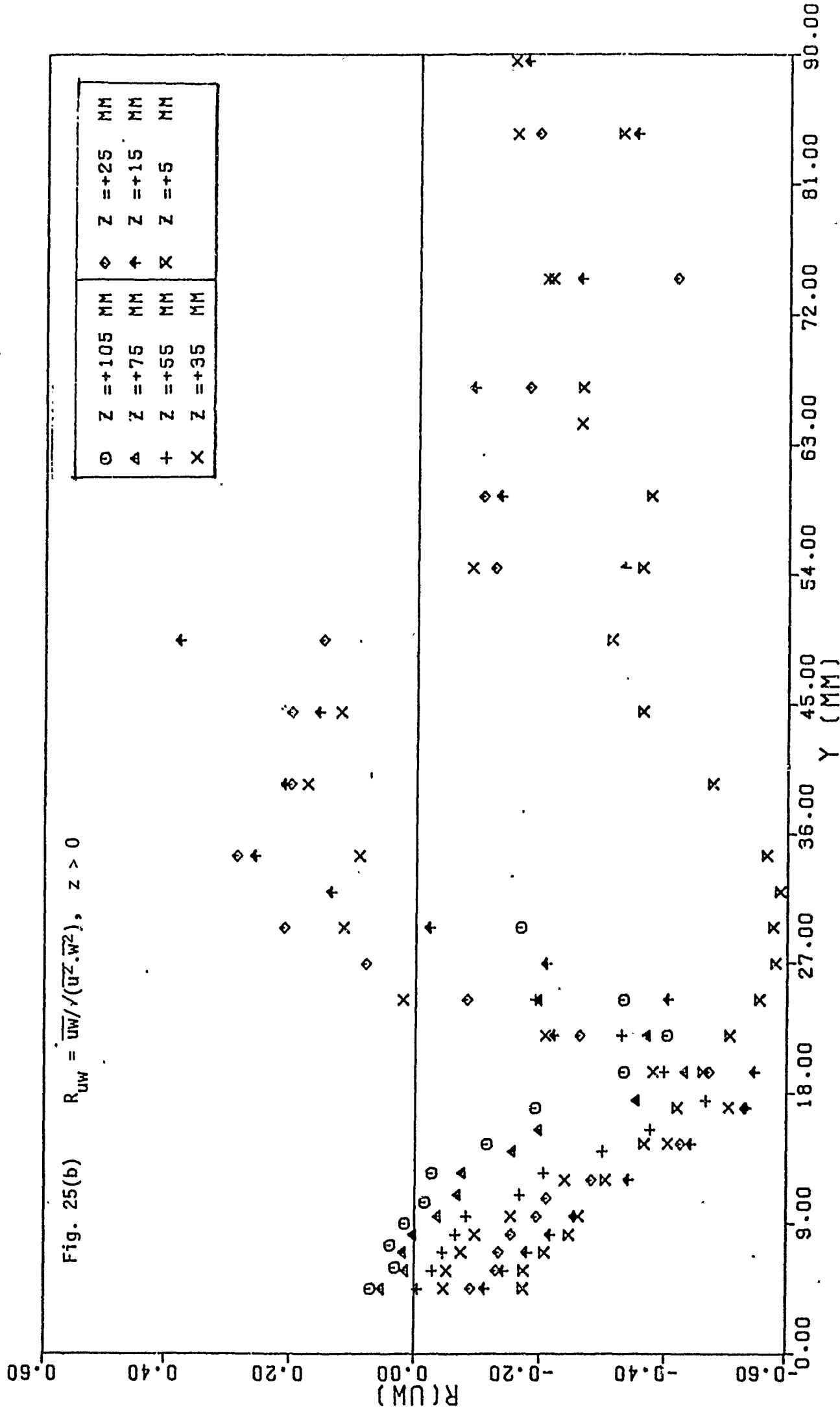
Fig. 25 Shear-stress correlation coefficients,  $x = 1350$  mm

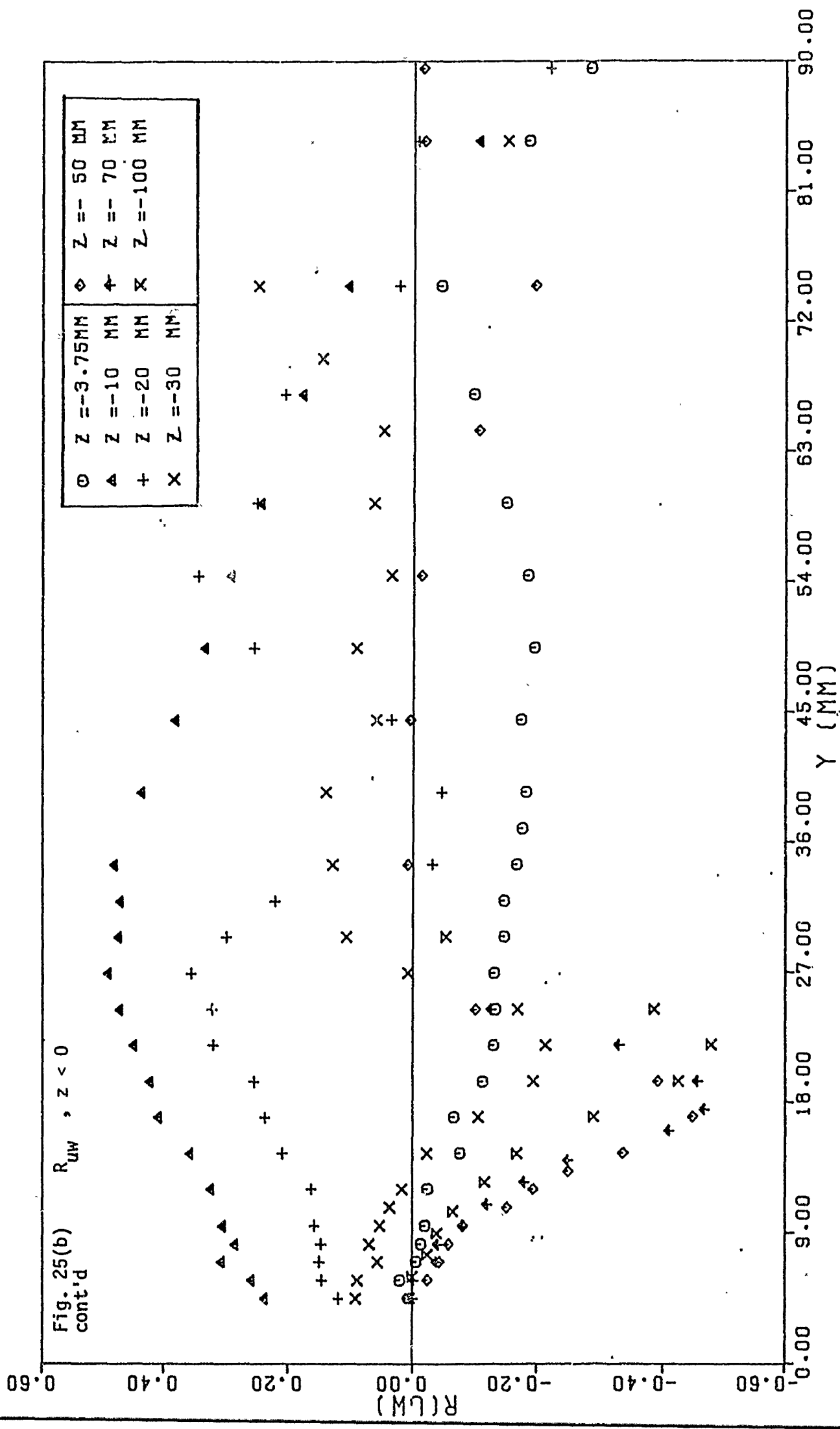
Fig. 25(a)  $R_{UV} = \overline{uv}/\sqrt{(u^2.v^2)}$ ,  $z > 0$

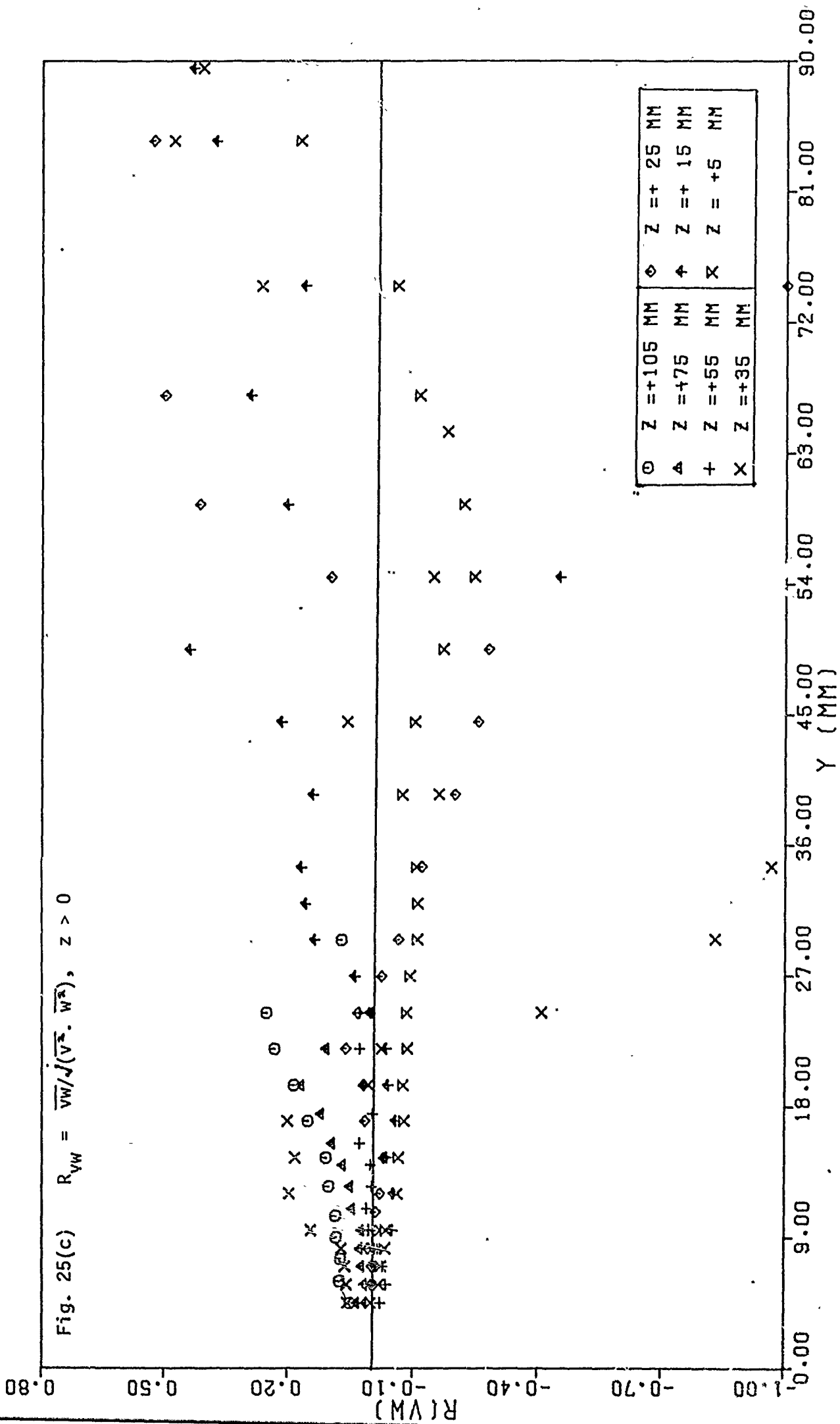
○	Z = +105	MM	◇	Z = +25	MM
▲	Z = +75	MM	†	Z = +15	MM
+	Z = +55	MM	×	Z = +5	MM
×	Z = +35	MM			

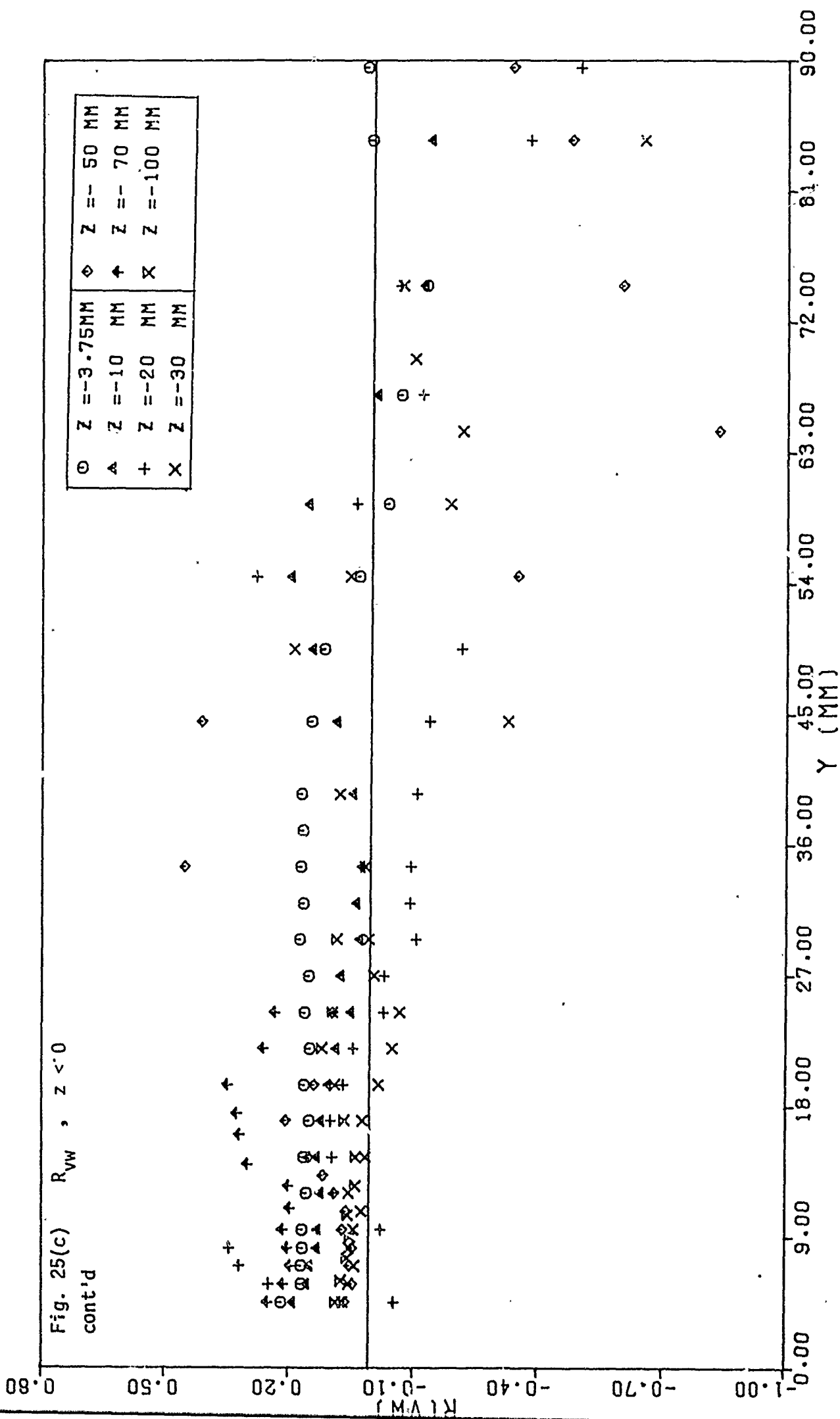


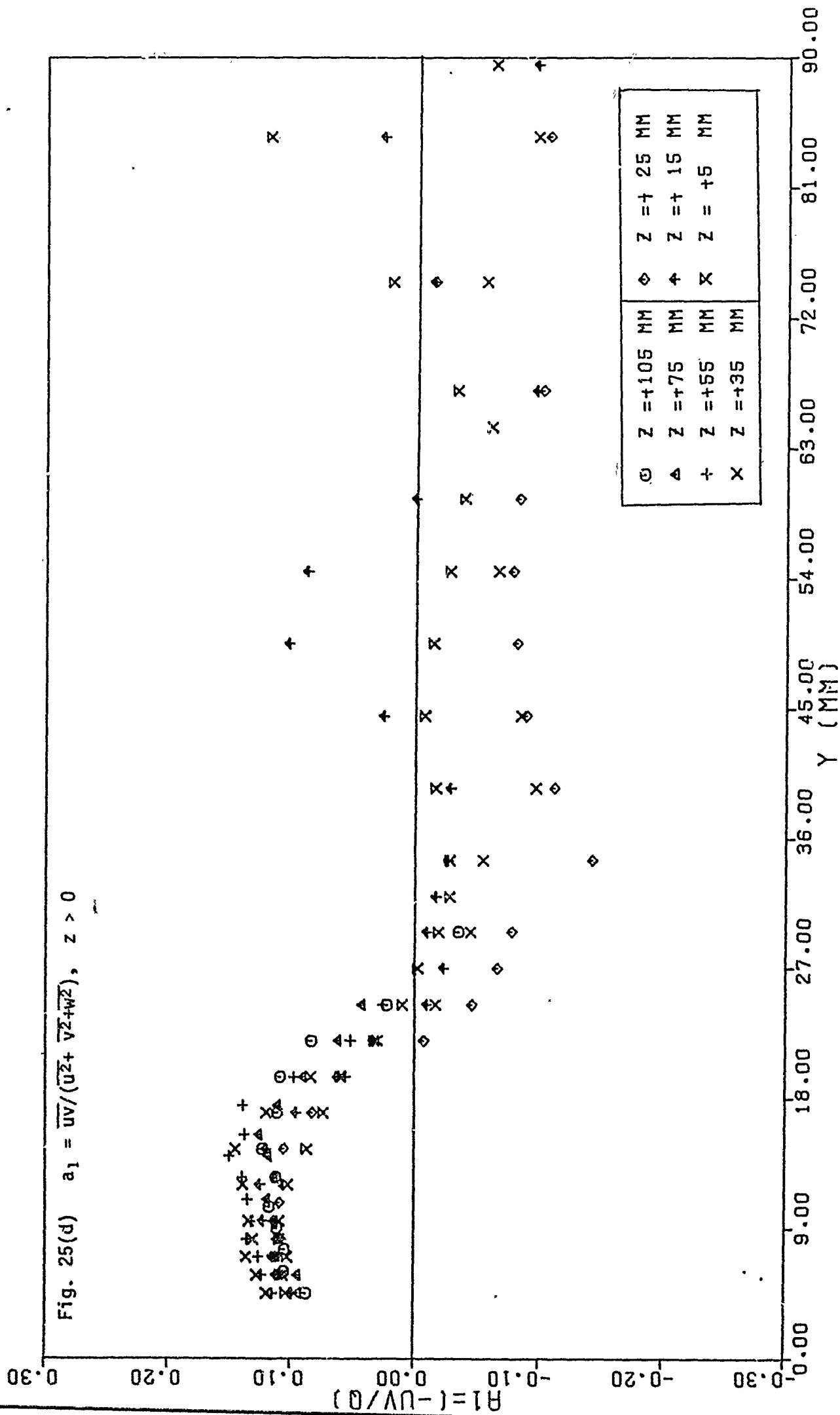


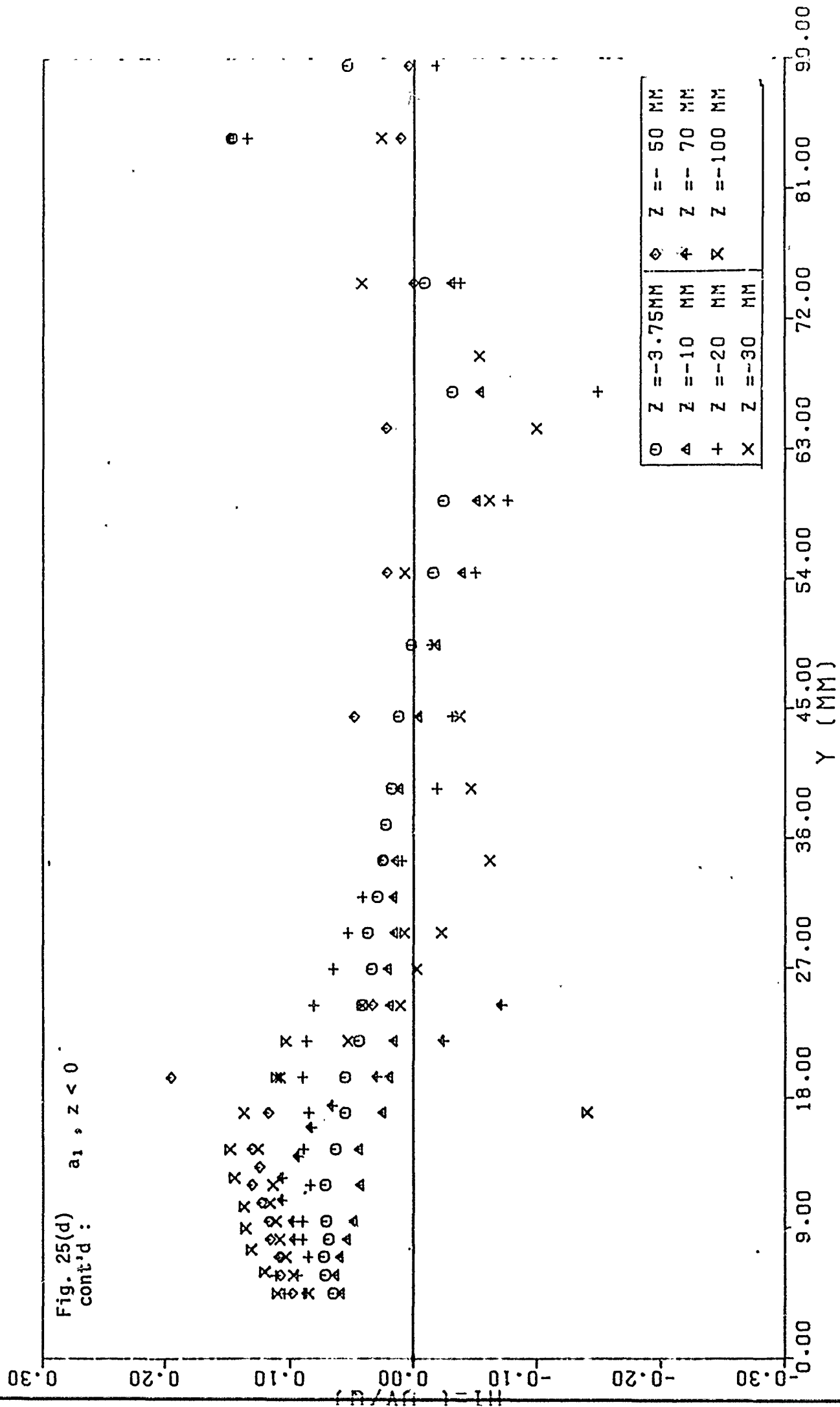






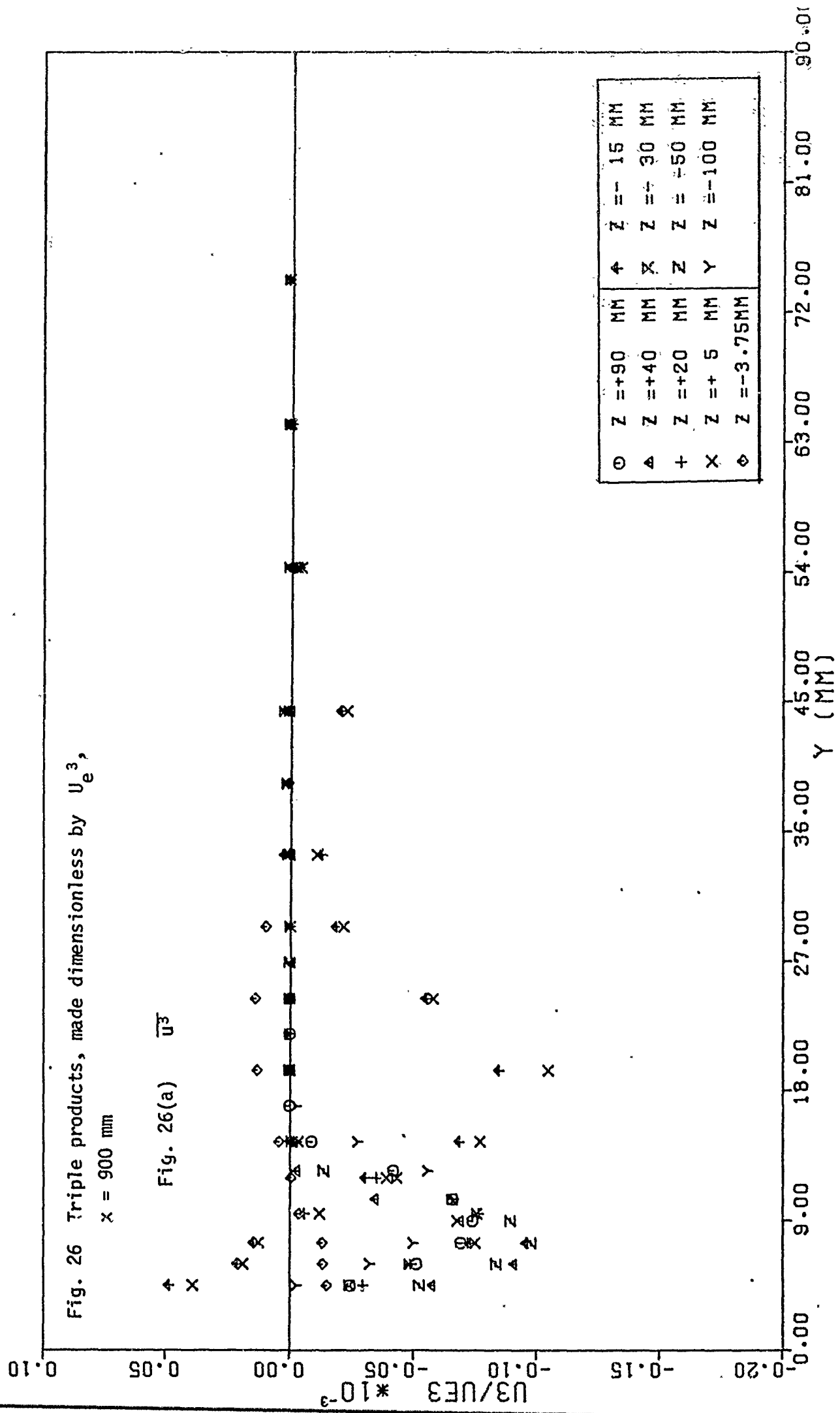






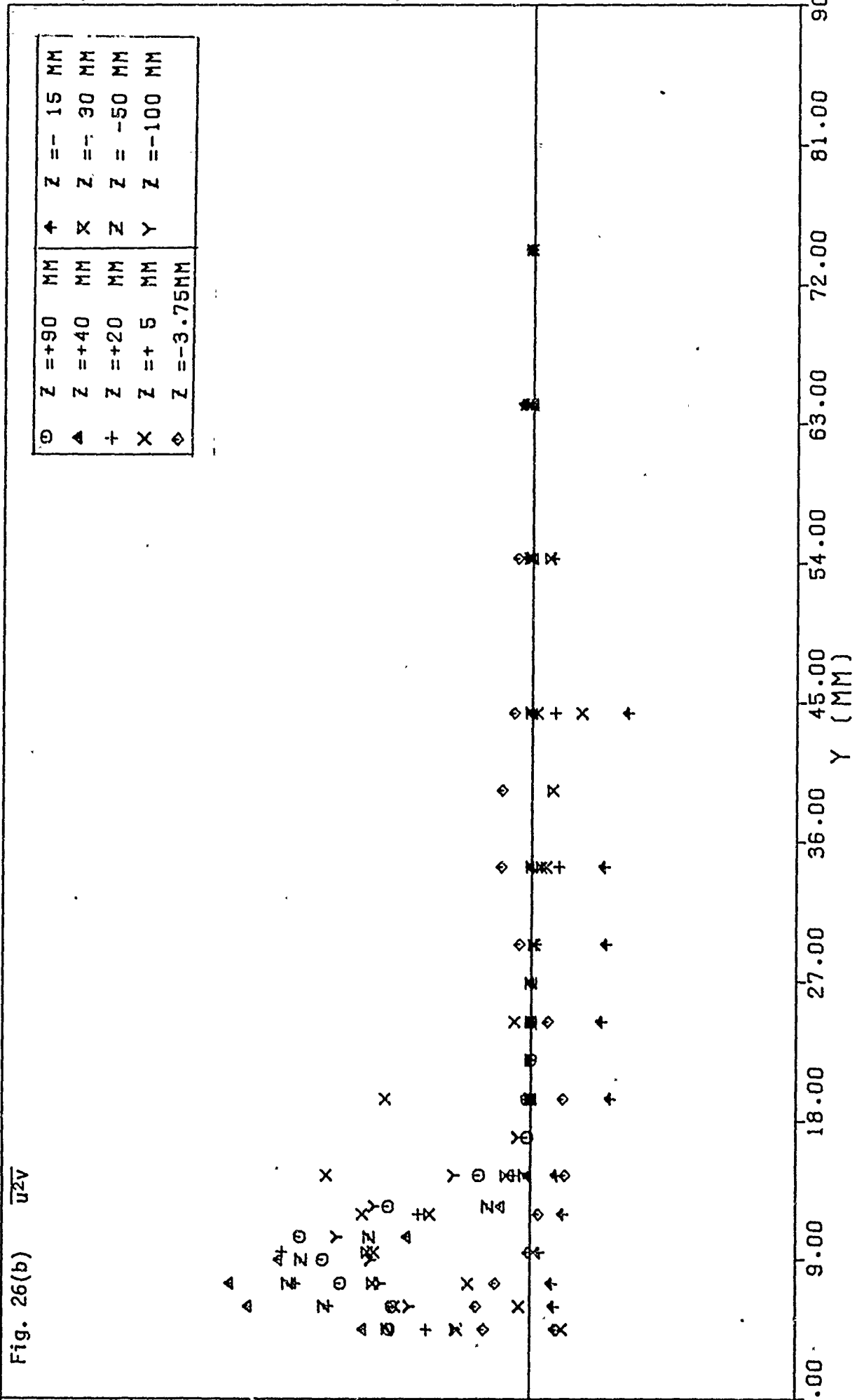
$\ominus$	Z = -3.75MM	$\diamond$	Z = -50 MM
$\Delta$	Z = -10 MM	$\star$	Z = -70 MM
+	Z = -20 MM	$\times$	Z = -100 MM
$\times$	Z = -30 MM		





0.06  
0.03  
0.045  
0.03  
0.015  
0.015  
0.00  
-0.015  
-0.03

Fig. 26(b)  $\overline{u^2v}$



Y (MM)

90.00

81.00

72.00

63.00

54.00

45.00

36.00

27.00

18.00

9.00

0.00

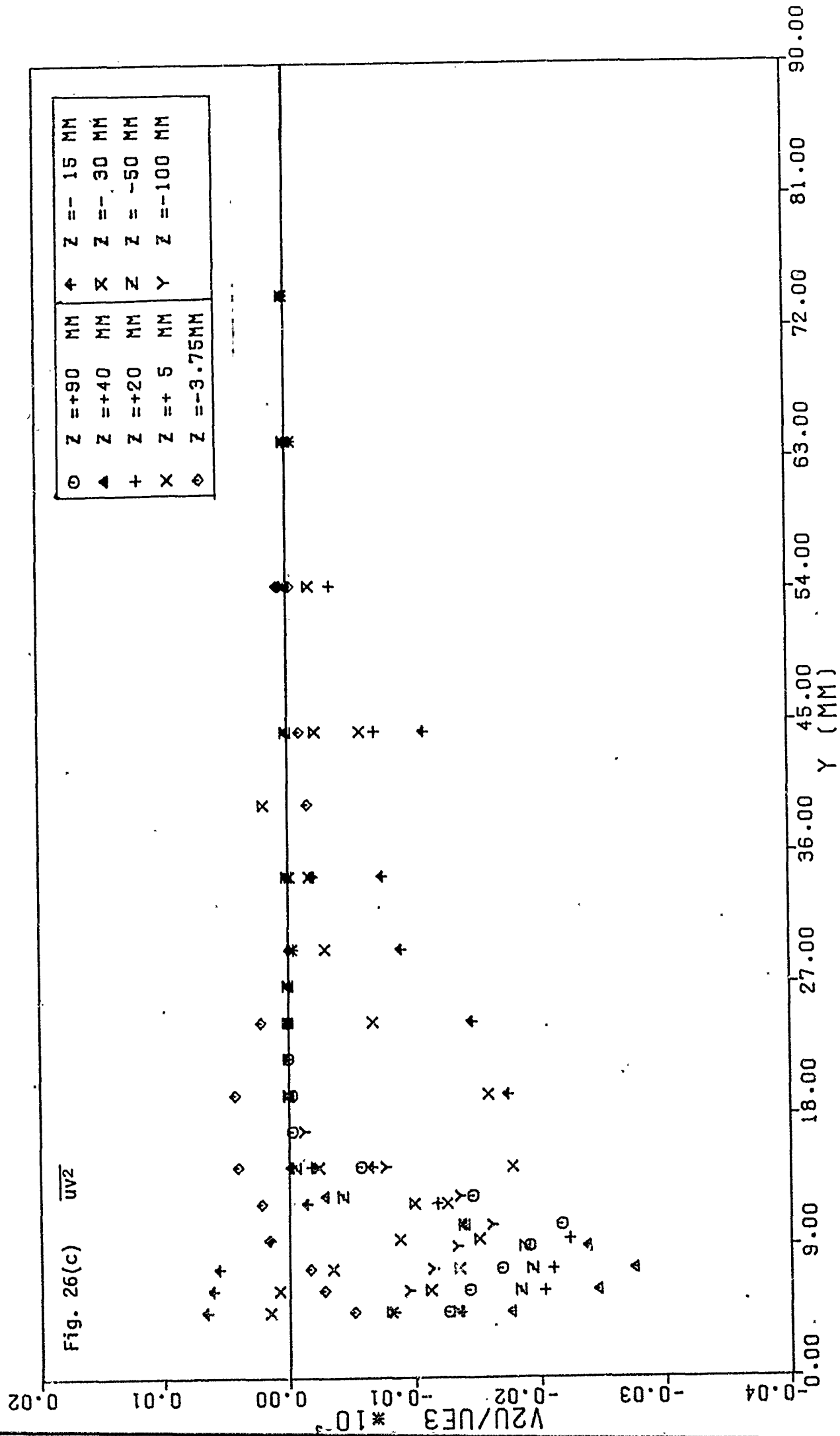


Fig. 26(d)  $\overline{V^3}$

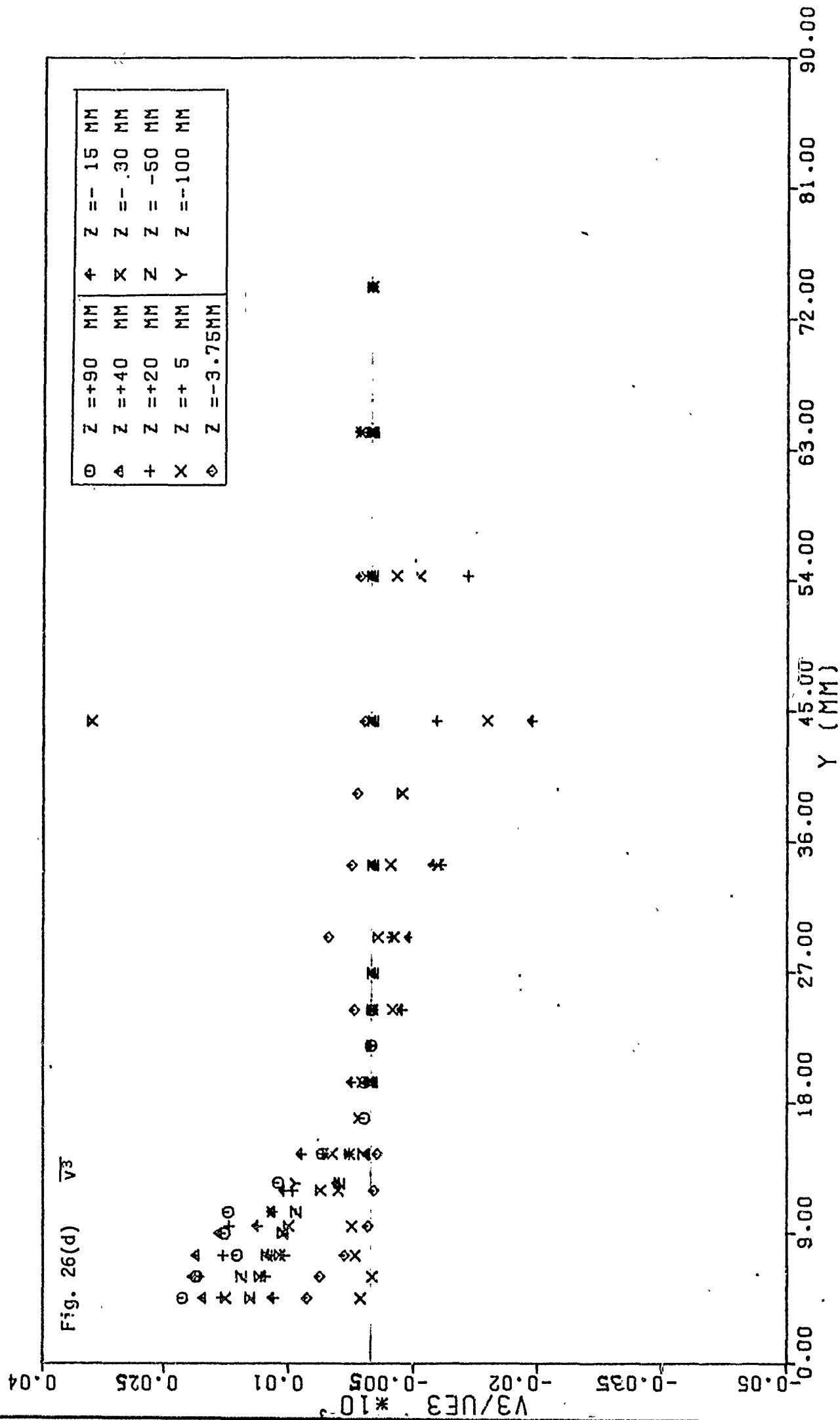


Fig. 26(e)

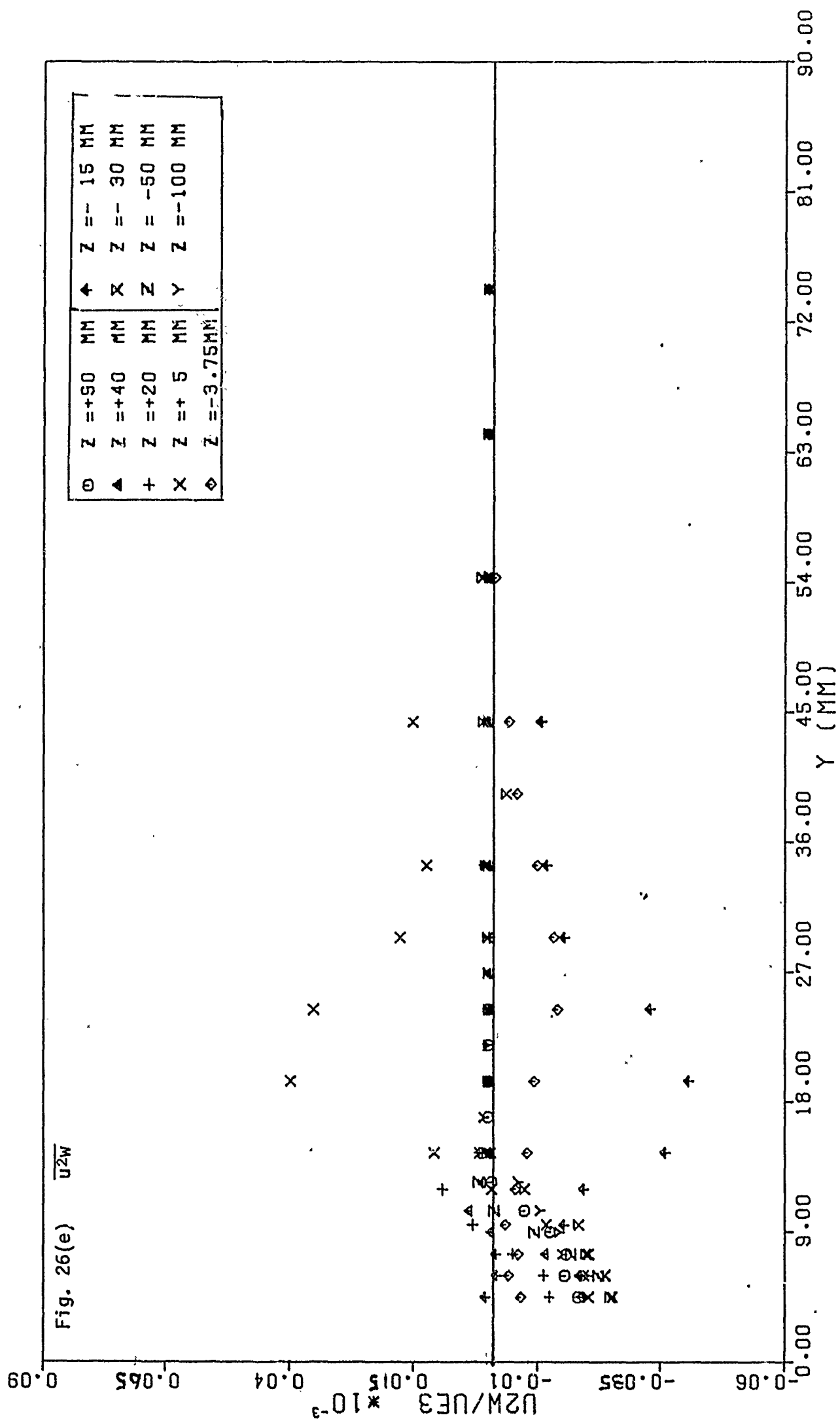
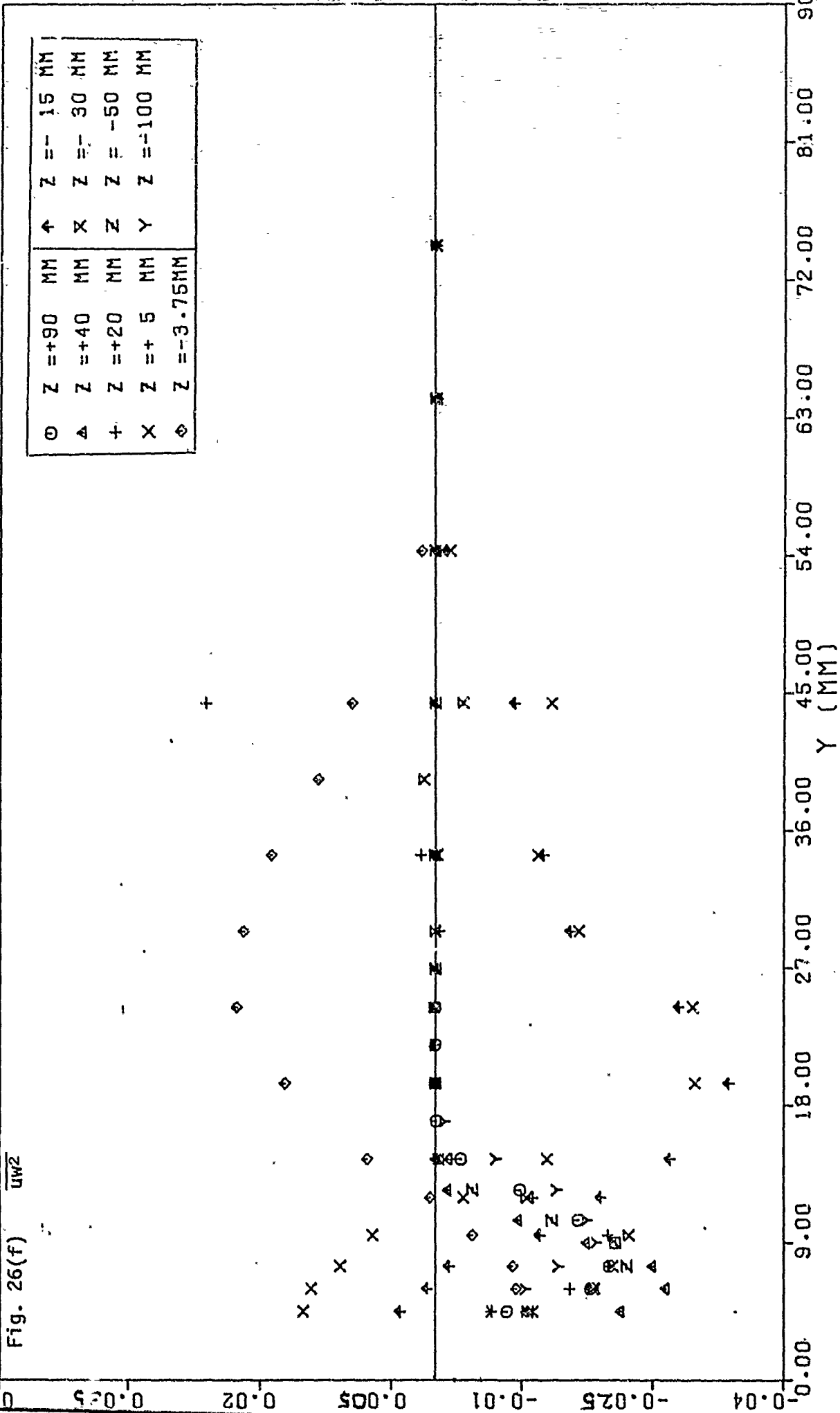
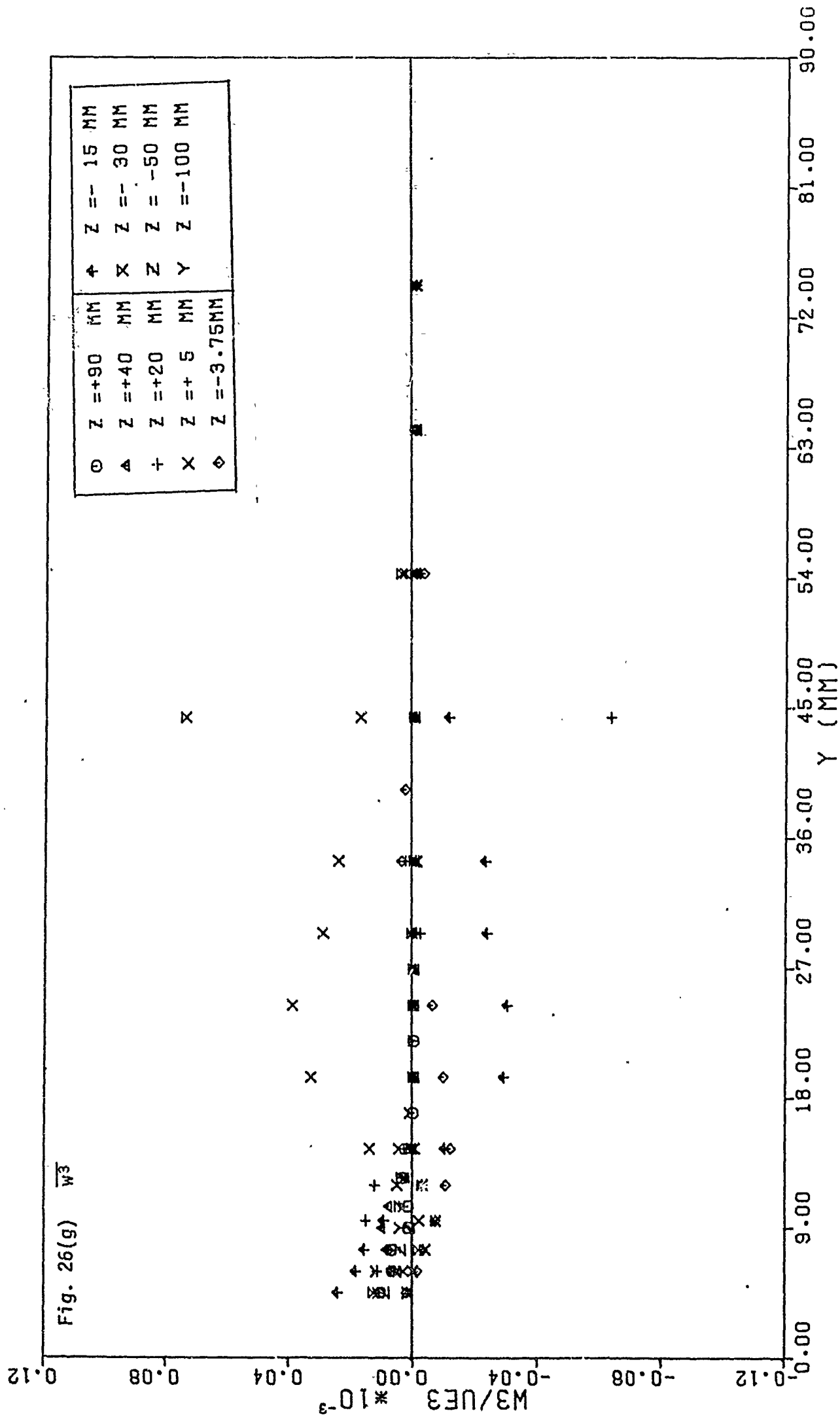
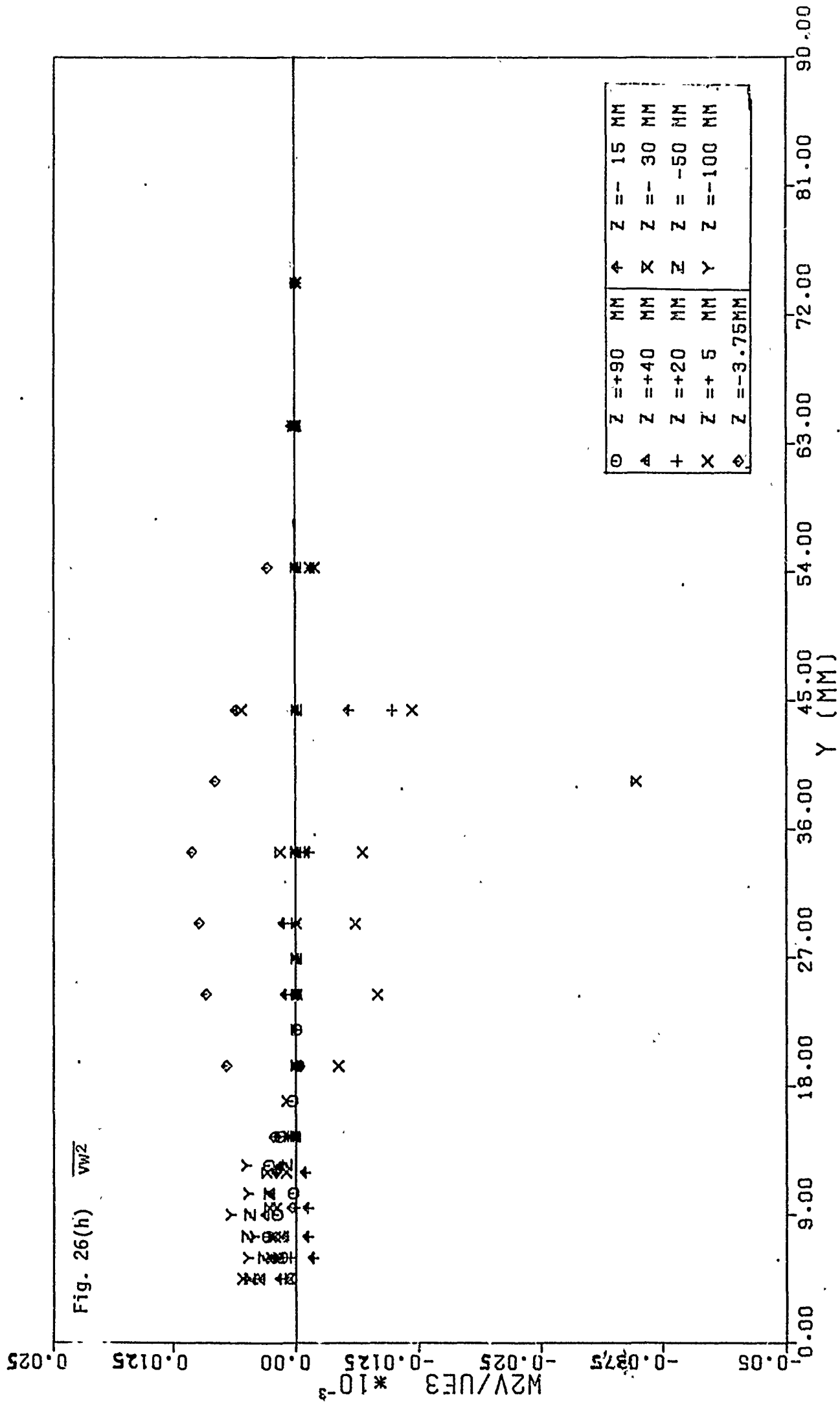


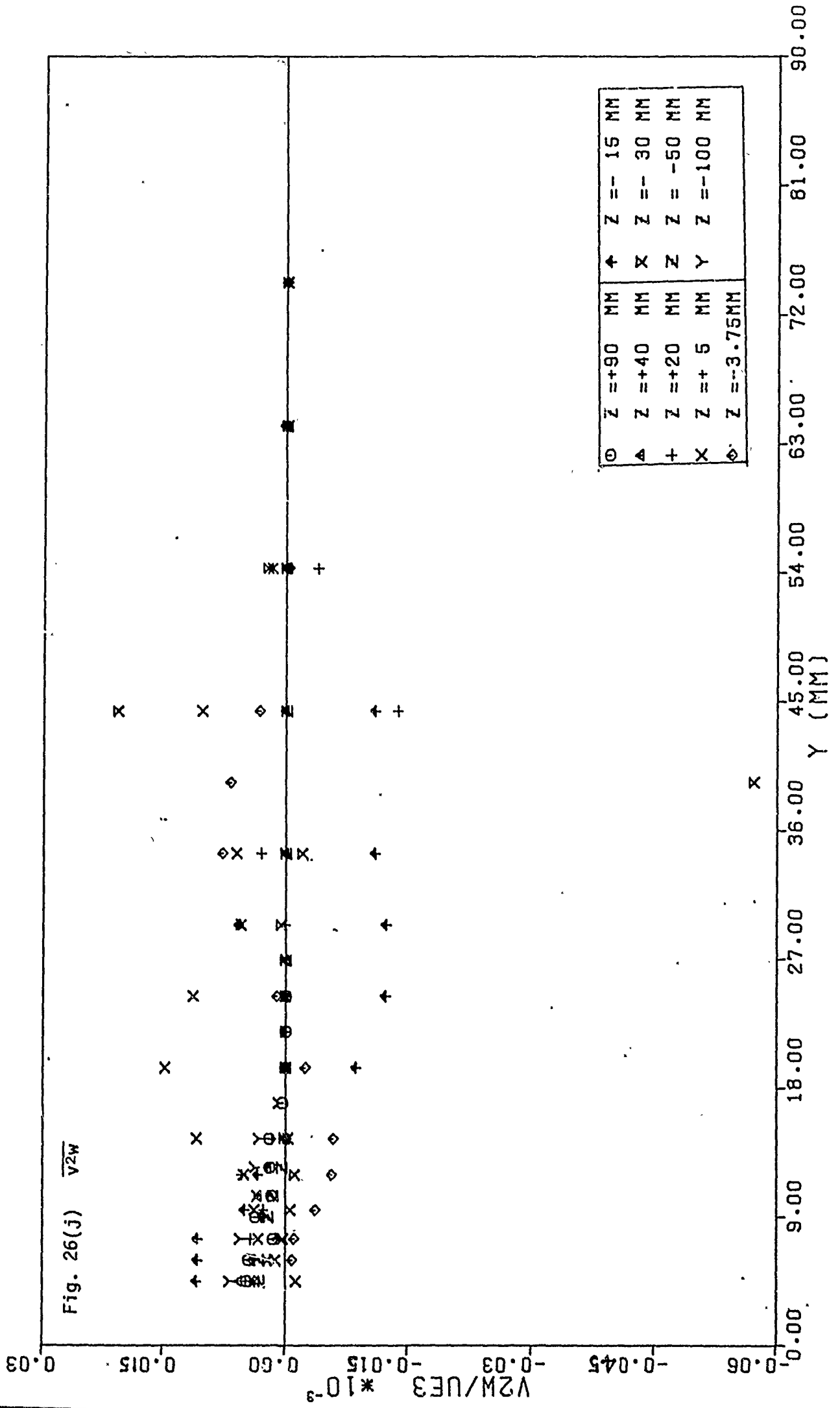
Fig. 26(f)  $\overline{uw^2}$

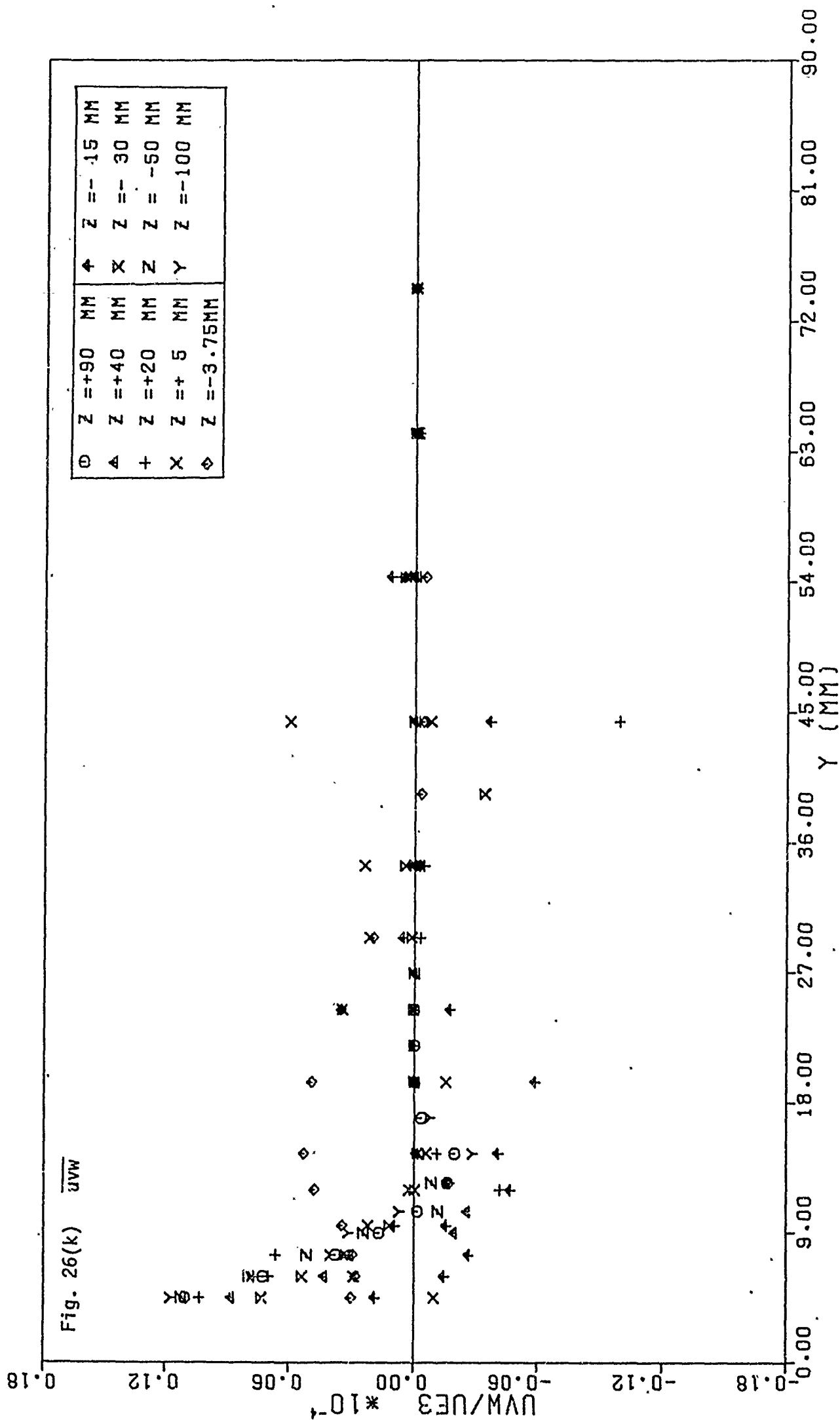












3:00

2:25

1:50

SKEM(V)

0:00

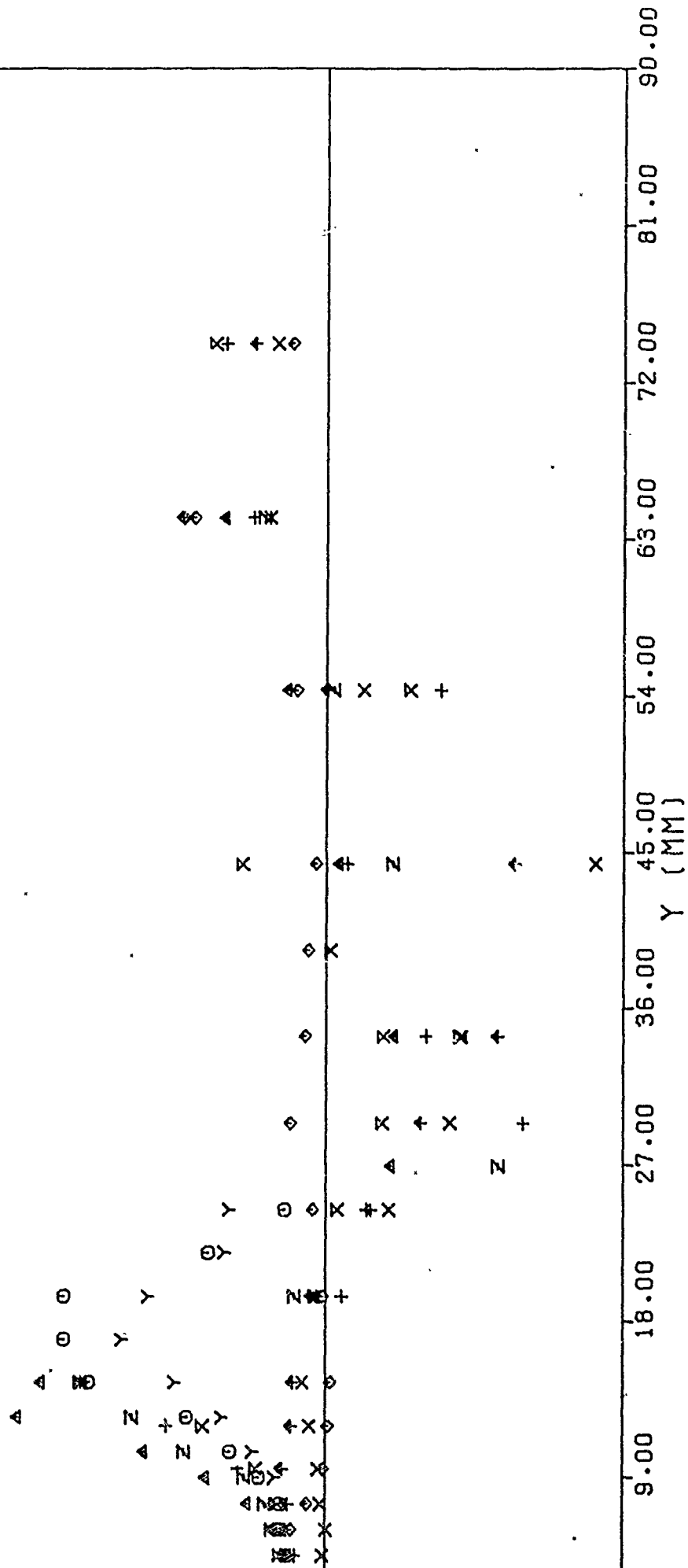
-0:75

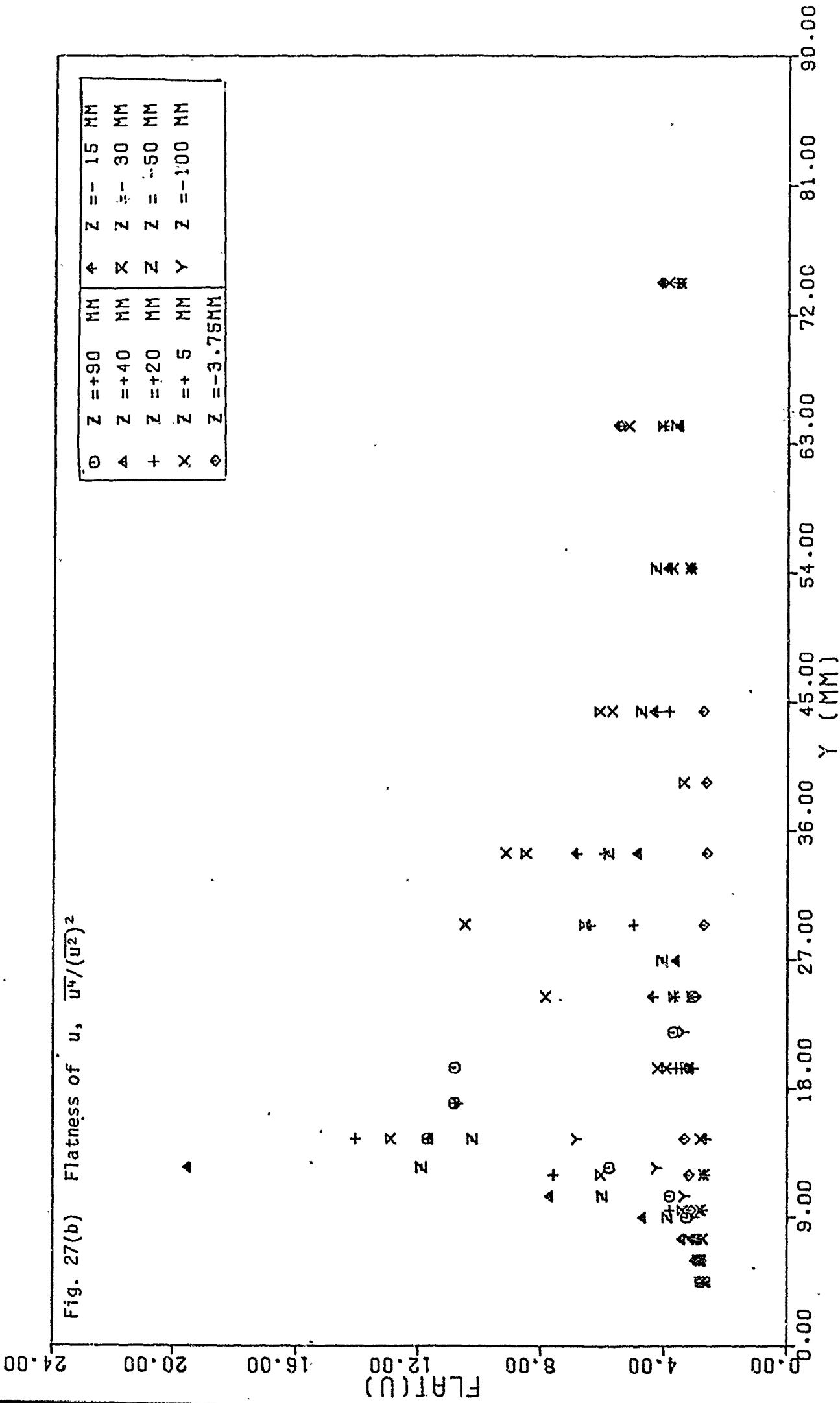
1:50

Fig. 27 Higher-order moments,  $x = 900$  mm

Fig. 27(a) Skewness of  $v$ ,  $\overline{v^3}/(\overline{v^2})^{3/2}$

○	Z = +90	MM	↑	Z = -15	MM
△	Z = +40	MM	X	Z = -30	MM
+	Z = +20	MM	Z	Z = -50	MM
X	Z = +5	MM	Y	Z = -100	MM
◇	Z = -3.75	MM			



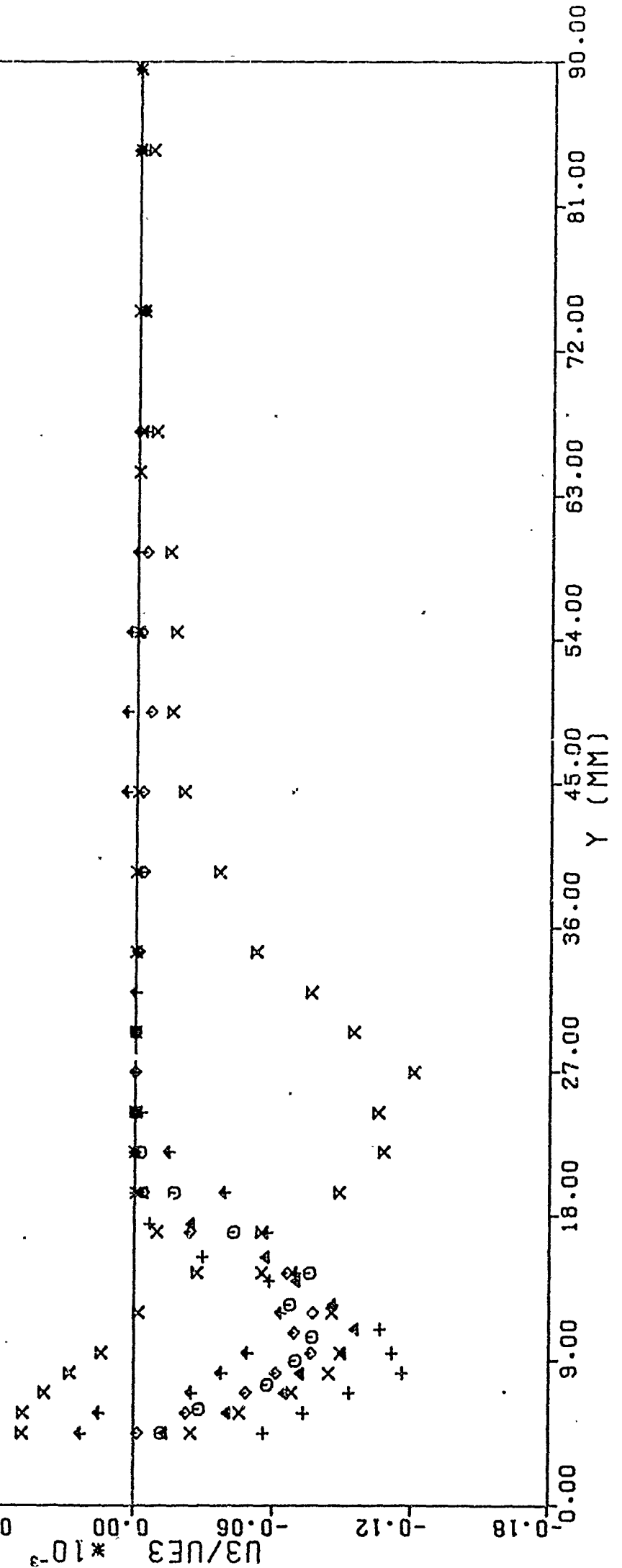


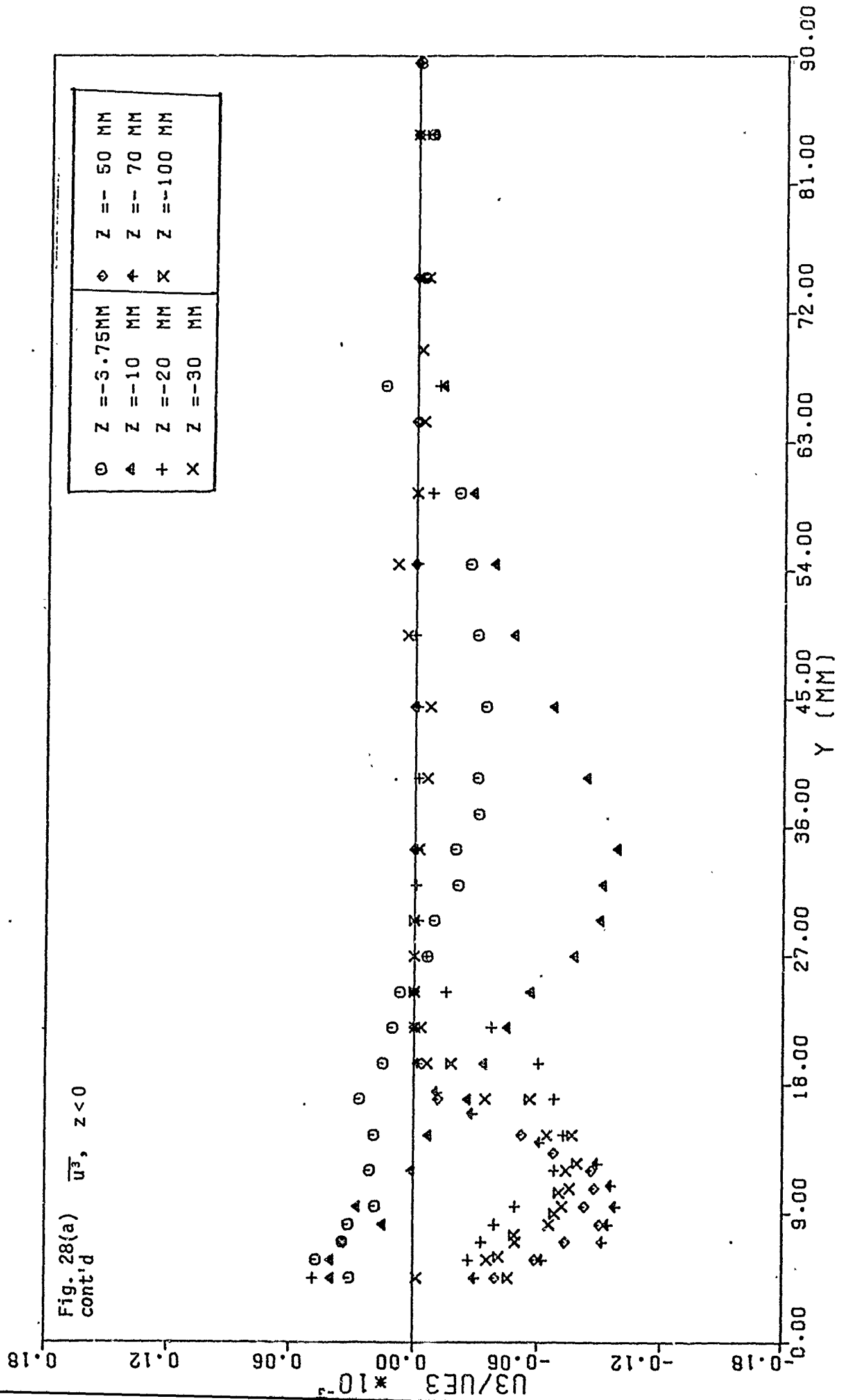
0.18  
0.12  
0.06  
0.00  
-0.06  
-0.12  
-0.18

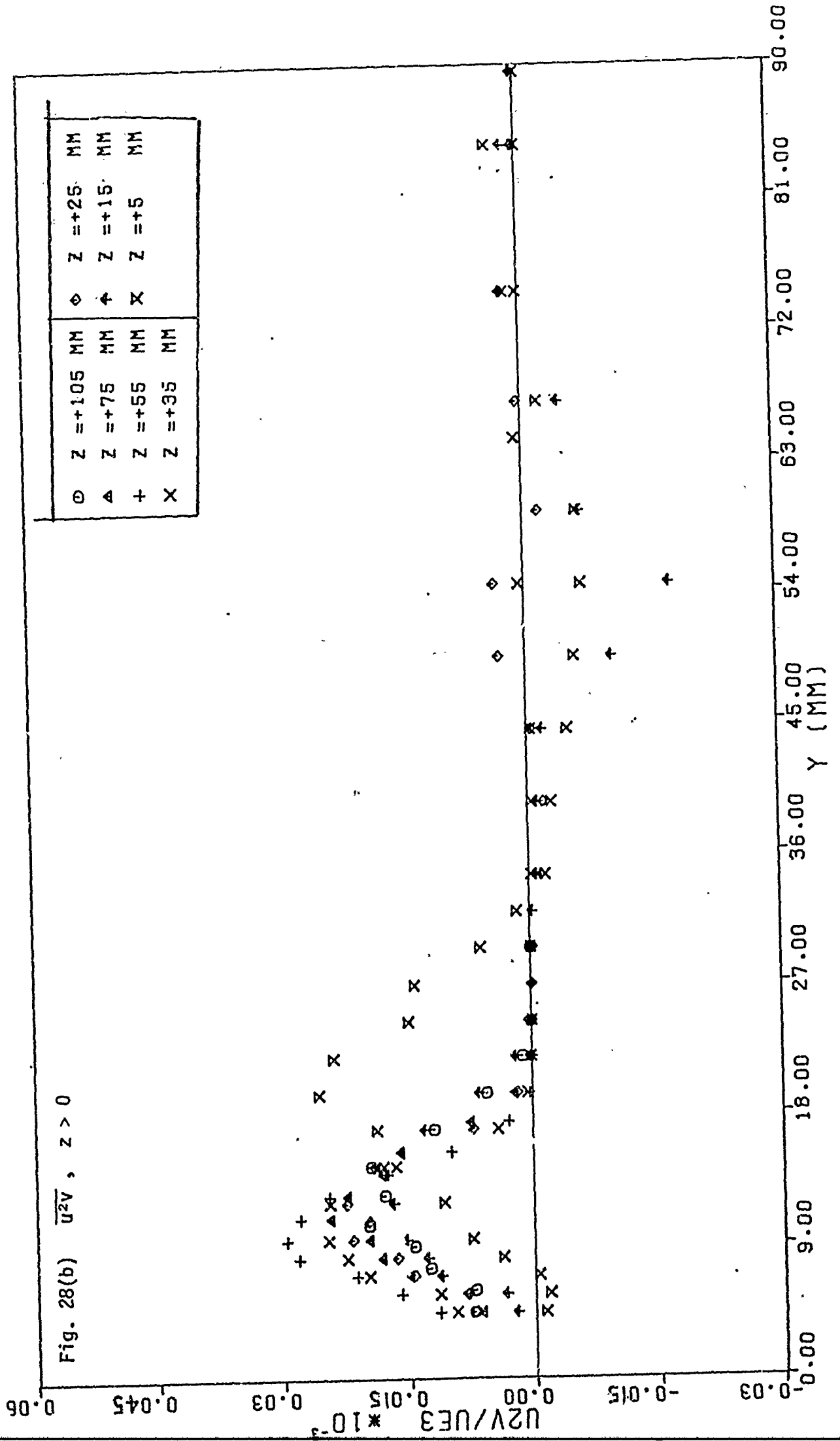
Fig. 28 Triple products, made dimensionless by  $U_e^3$ ,  $x = 1350$  mm

Fig. 28(a)  $\overline{u^3}$ ,  $z > 0$

○	Z = +105 MM	◇	Z = + 25 MM
△	Z = +75 MM	+	Z = + 15 MM
×	Z = +55 MM	×	Z = + 5 MM
×	Z = +35 MM		



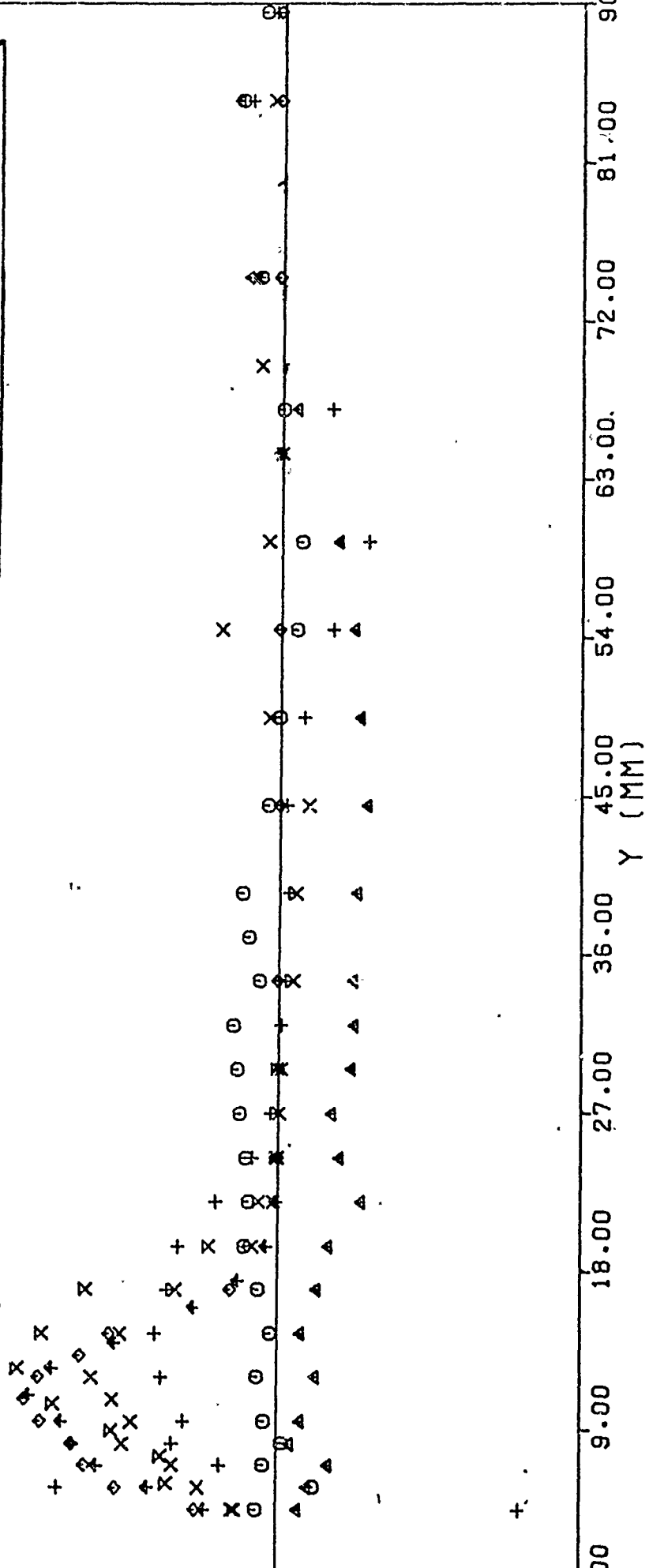




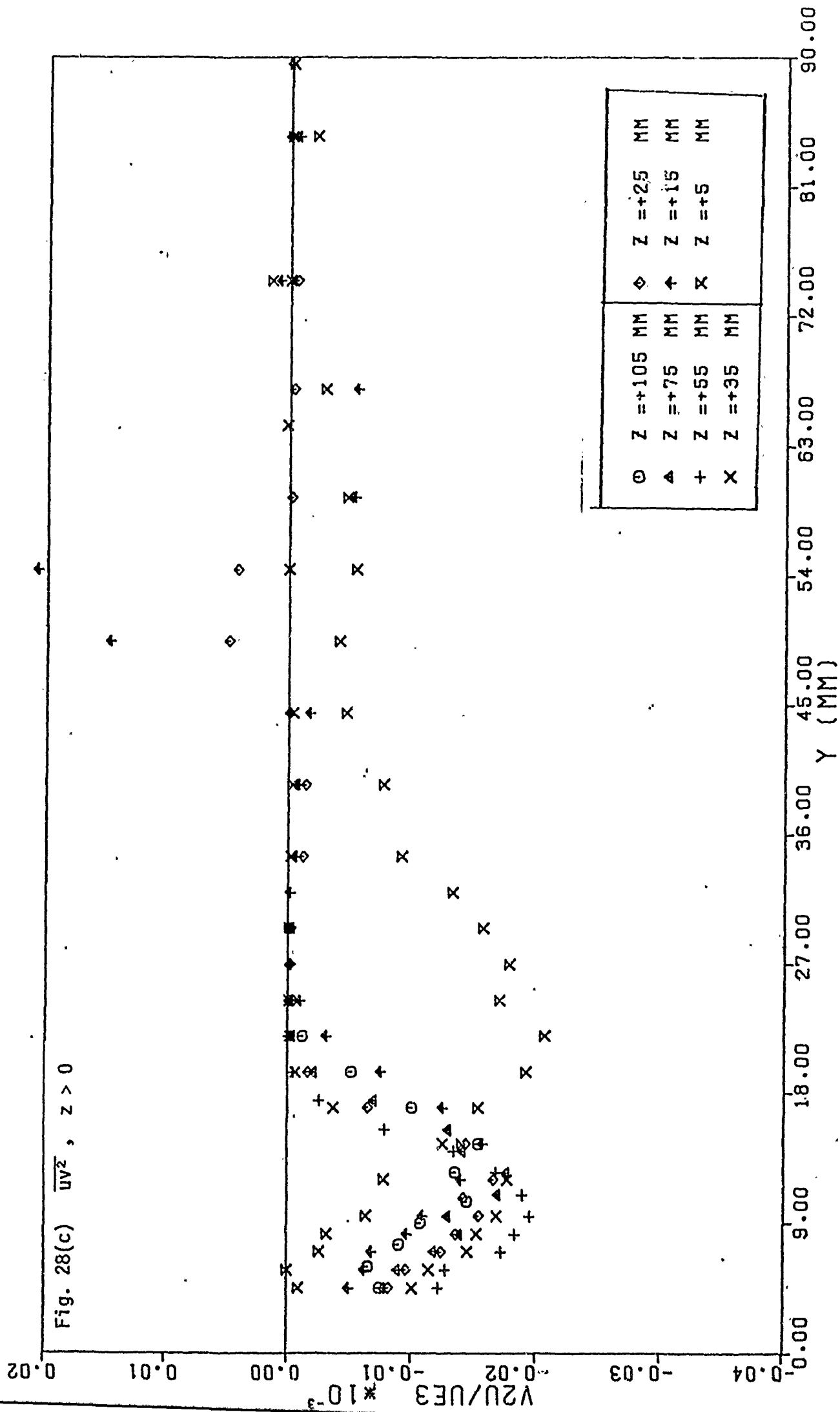
$U2V/UE3 \times 10^{-3}$   
 0.06  
 0.045  
 0.03  
 0.015  
 0.00  
 -0.015  
 -0.03

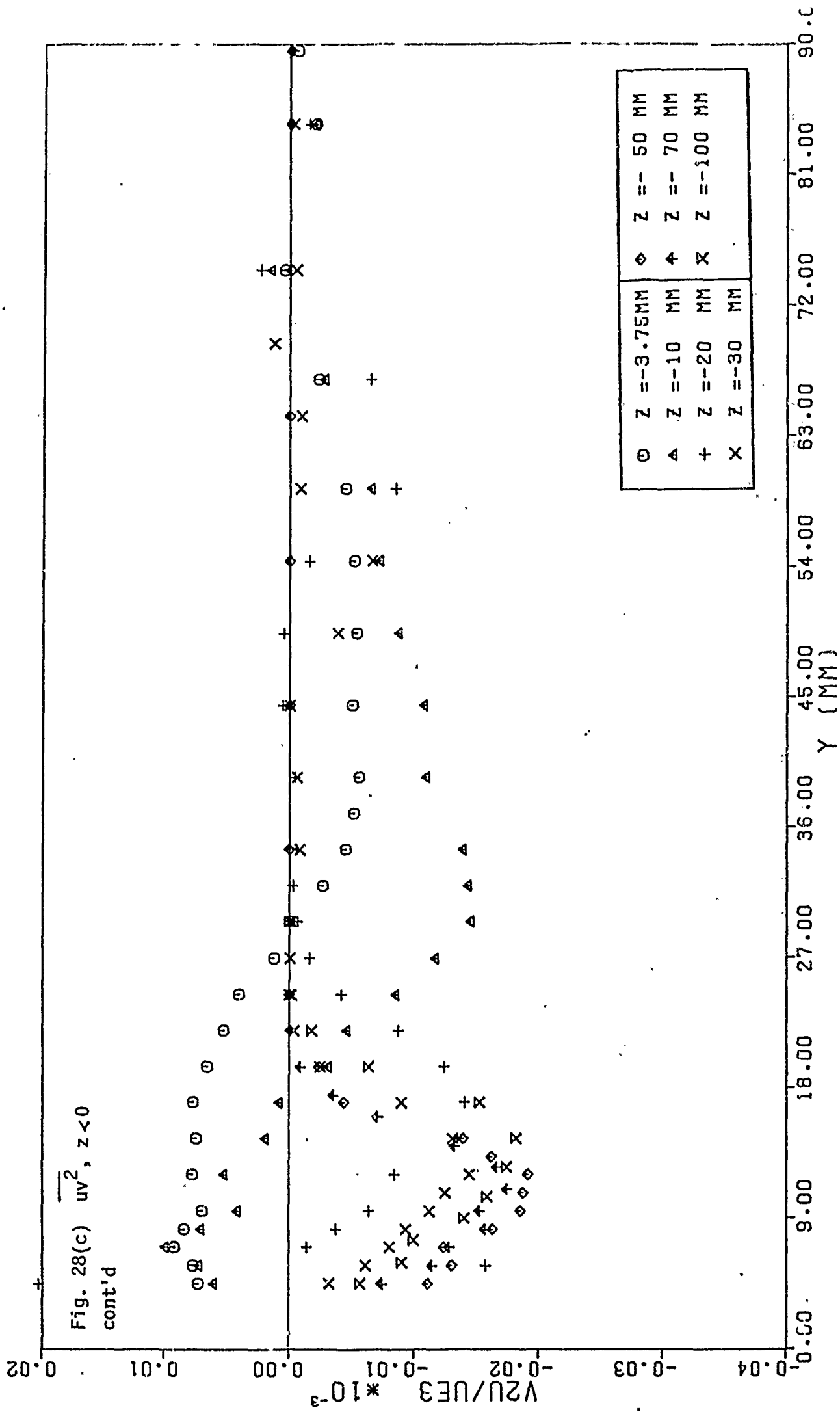
Fig. 28(b)  
cont'd  $\overline{u^2v}$ ,  $z < 0$

$\diamond$	$Z = -3.75$ MM	$\diamond$	$Z = -50$ MM
$\triangle$	$Z = -10$ MM	$+$	$Z = -70$ MM
$+$	$Z = -20$ MM	$\times$	$Z = -100$ MM
$\times$	$Z = -30$ MM		









0.04

0.025

0.01

-0.005

-0.02

-0.035

-0.05

0.00

9.00

18.00

27.00

36.00

45.00

54.00

63.00

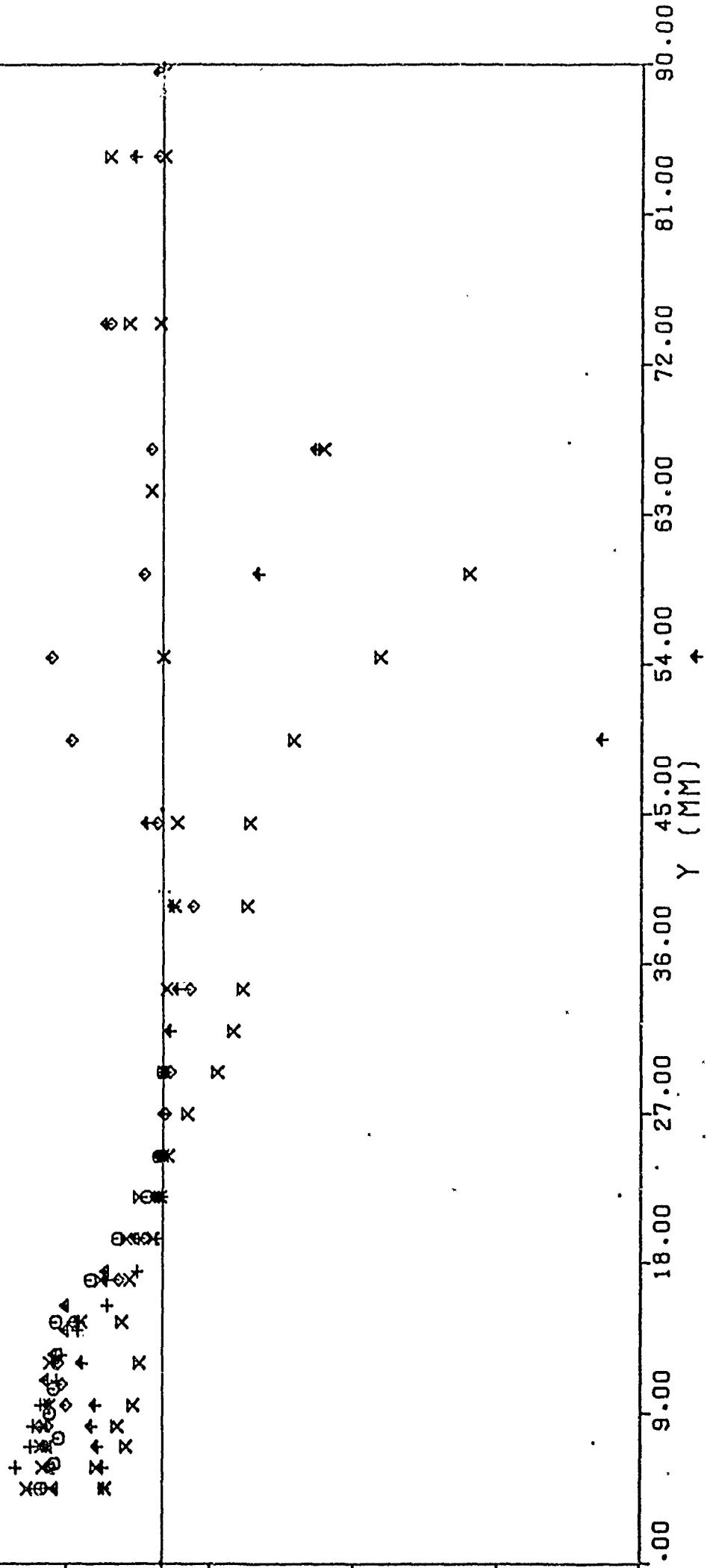
72.00

81.00

90.00

Fig. 28(d)  $\bar{V}^3$ ,  $z > 0$

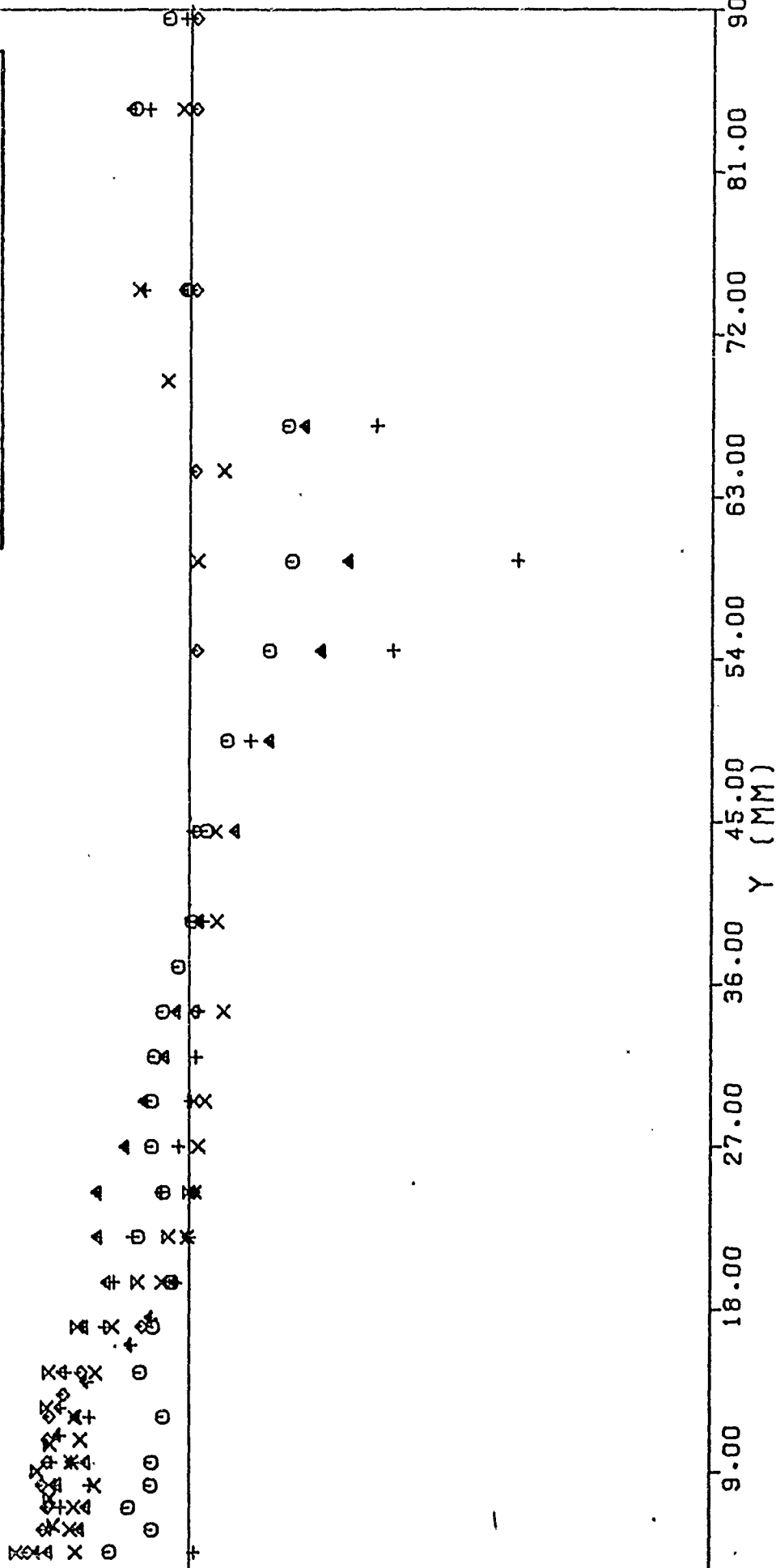
$\odot$	$Z = +105$ MM	$\diamond$	$Z = +25$ MM
$\triangle$	$Z = +75$ MM	$\uparrow$	$Z = +15$ MM
$+$	$Z = +55$ MM	$\times$	$Z = +5$ MM
$\times$	$Z = +35$ MM		



$V3/UE3 \times 10^3$

Fig. 28(d)  $\overline{V^3}$ ,  $z < 0$   
cont'd

$\ominus$	$Z = -3.75$ MM	$\diamond$	$Z = -50$ MM
$\blacktriangle$	$Z = -10$ MM	$\oplus$	$Z = -70$ MM
$+$	$Z = -20$ MM	$\times$	$Z = -100$ MM
$\times$	$Z = -30$ MM		



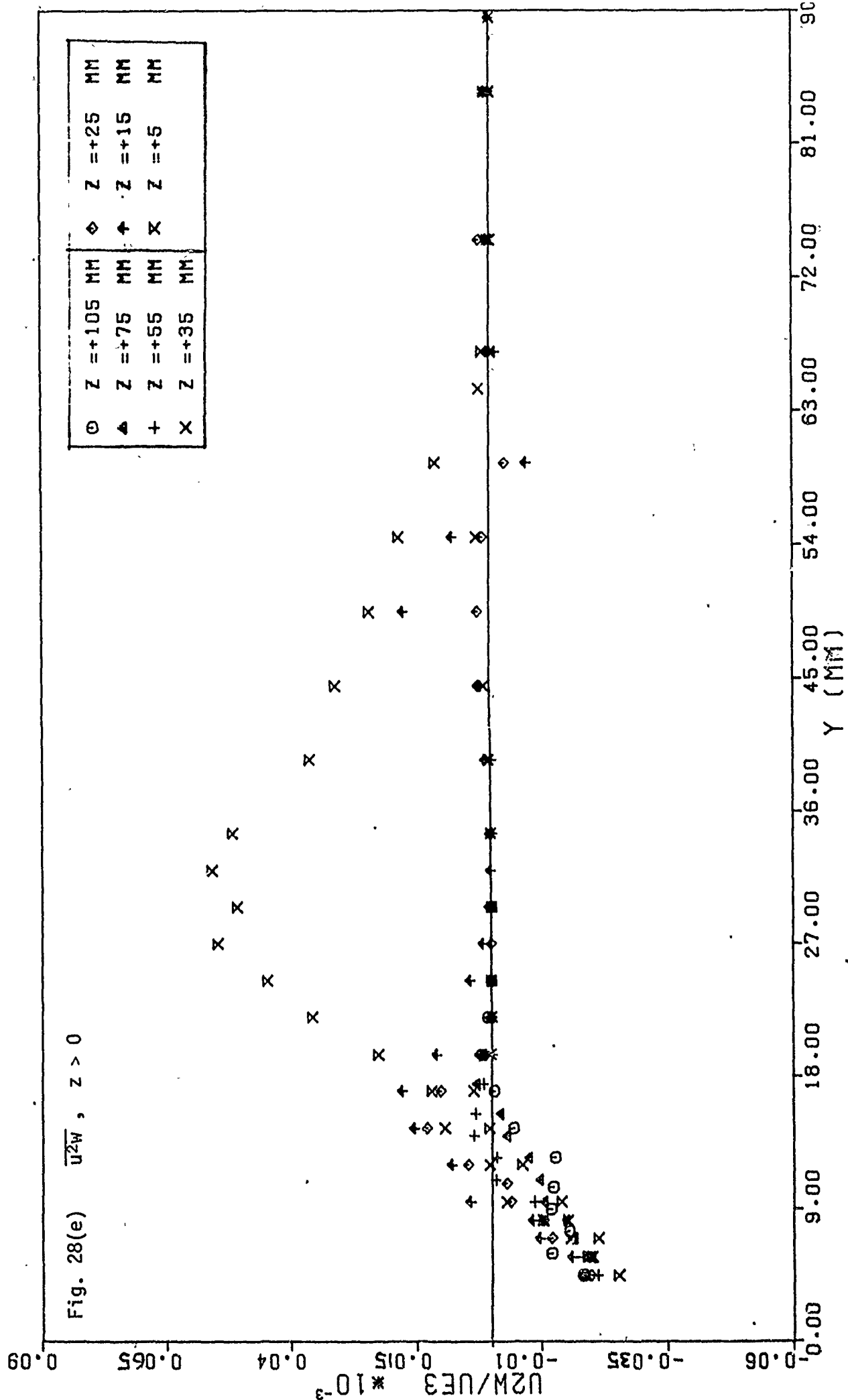
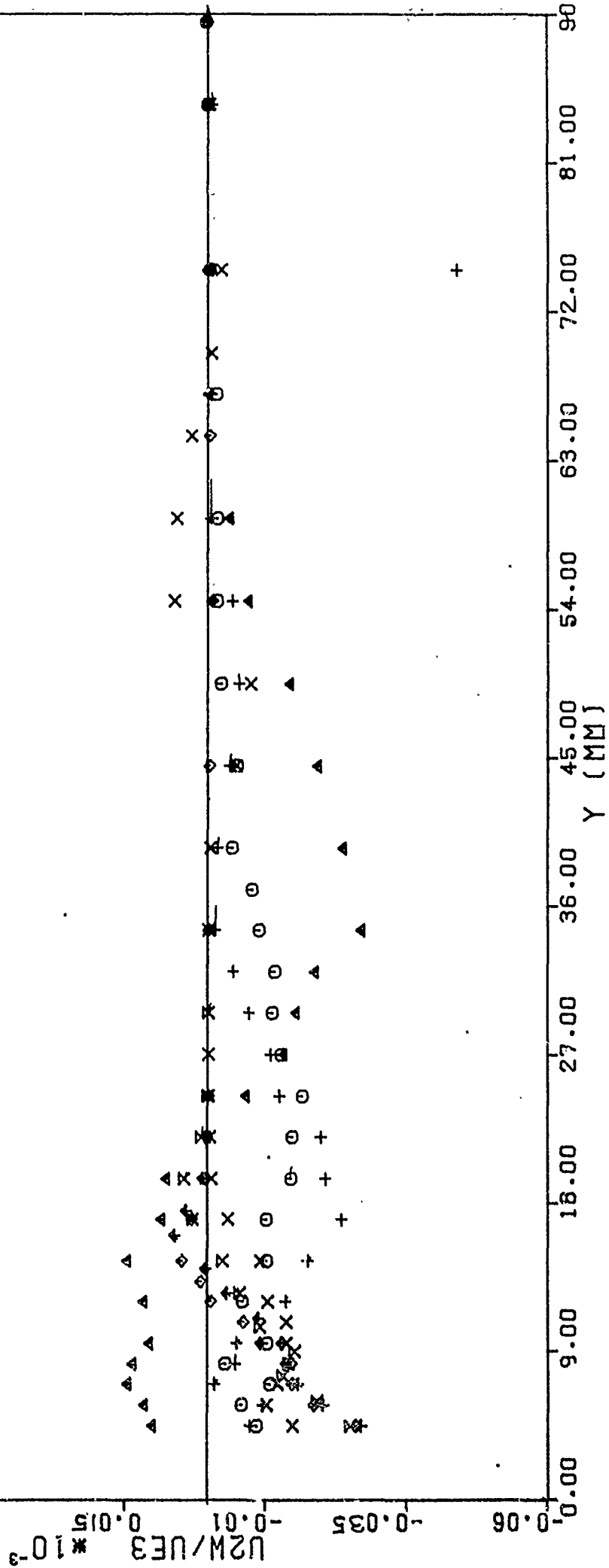
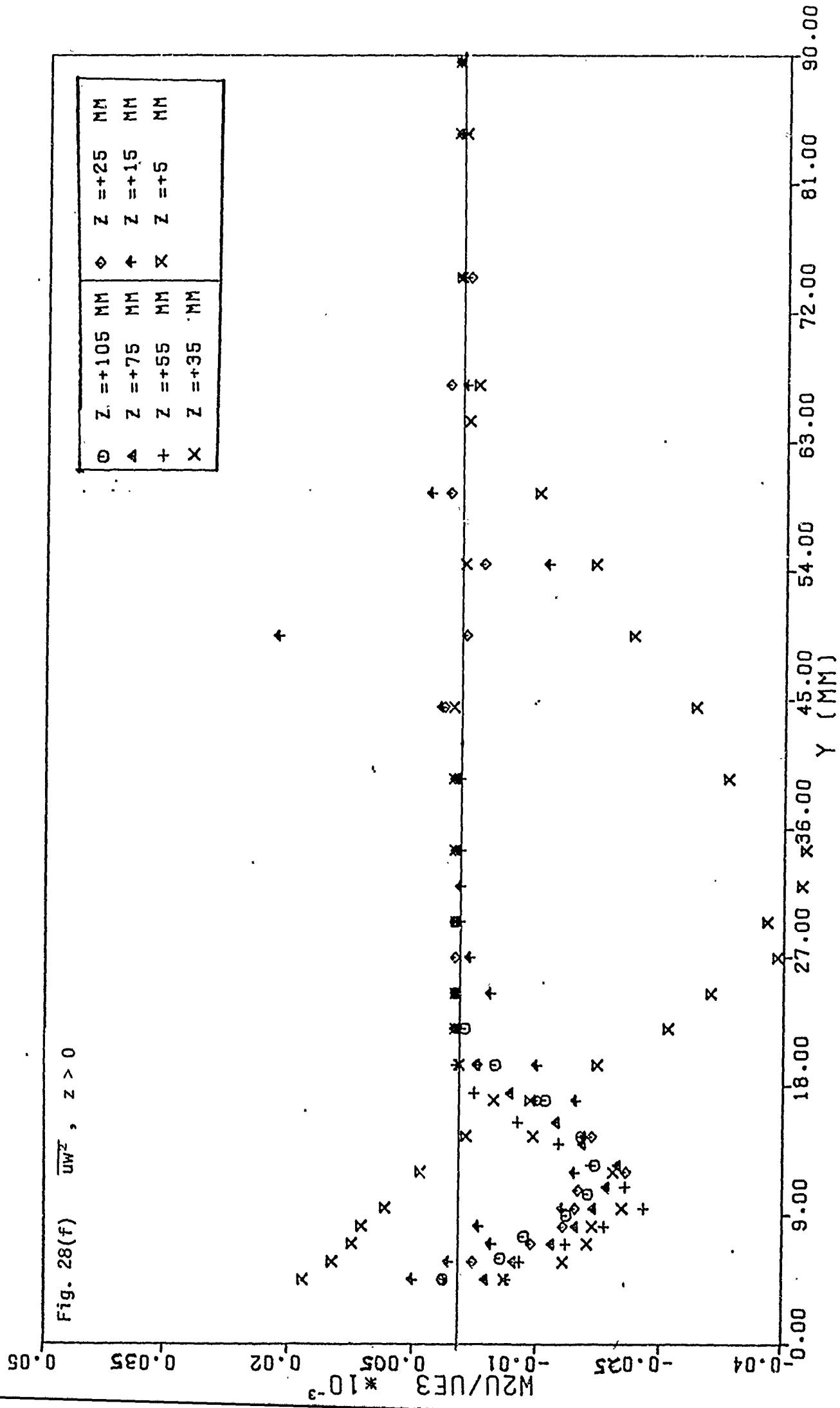
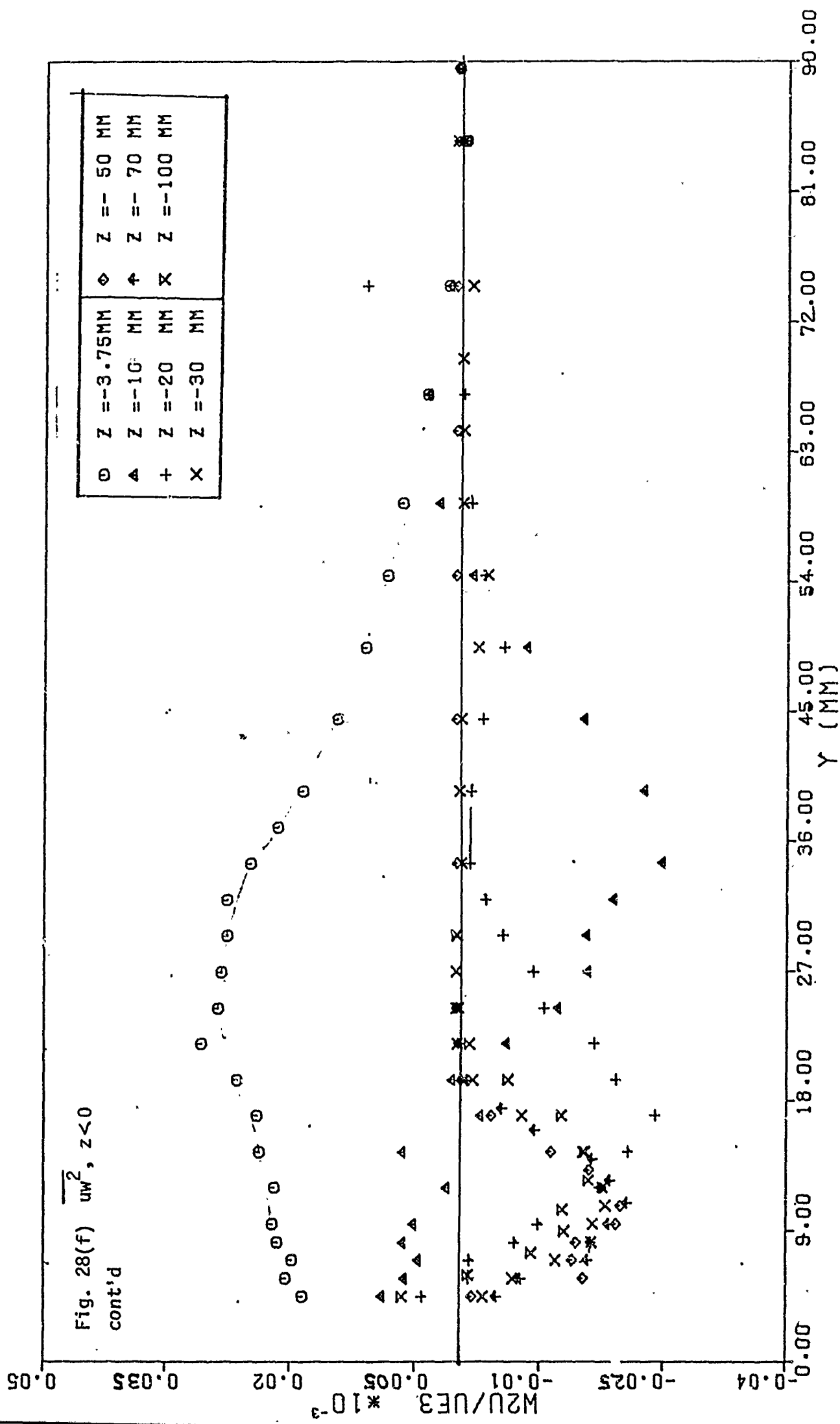


Fig. 28(e)  $\overline{u^2_w}$ ,  $z < 0$   
cont'd

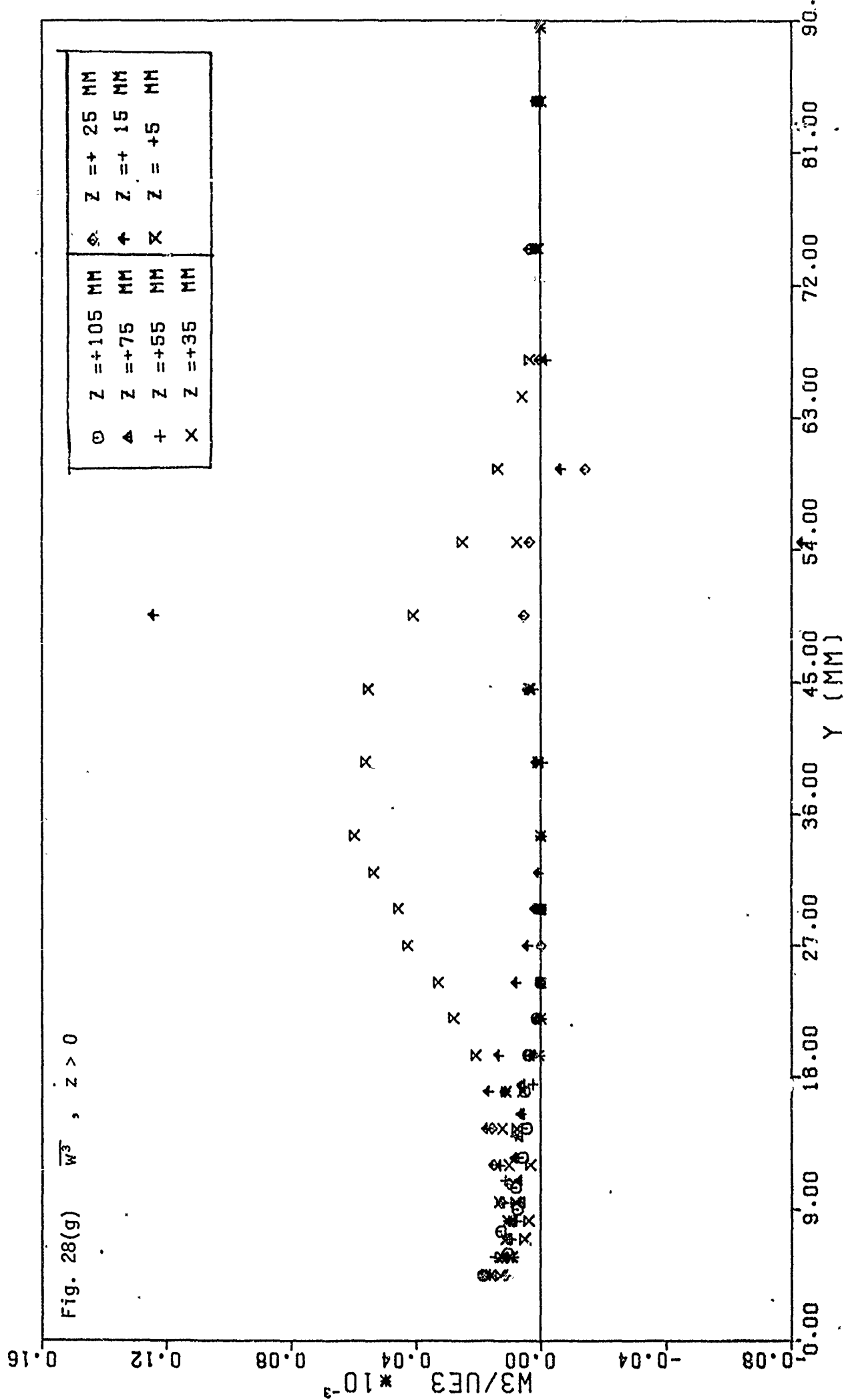
$\ominus$	$Z = -3.75 \text{ MM}$	$\diamond$	$Z = -50 \text{ MM}$
$\blacktriangle$	$Z = -10 \text{ MM}$	$+$	$Z = -70 \text{ MM}$
$+$	$Z = -20 \text{ MM}$	$\times$	$Z = -100 \text{ MM}$
$\times$	$Z = -30 \text{ MM}$		

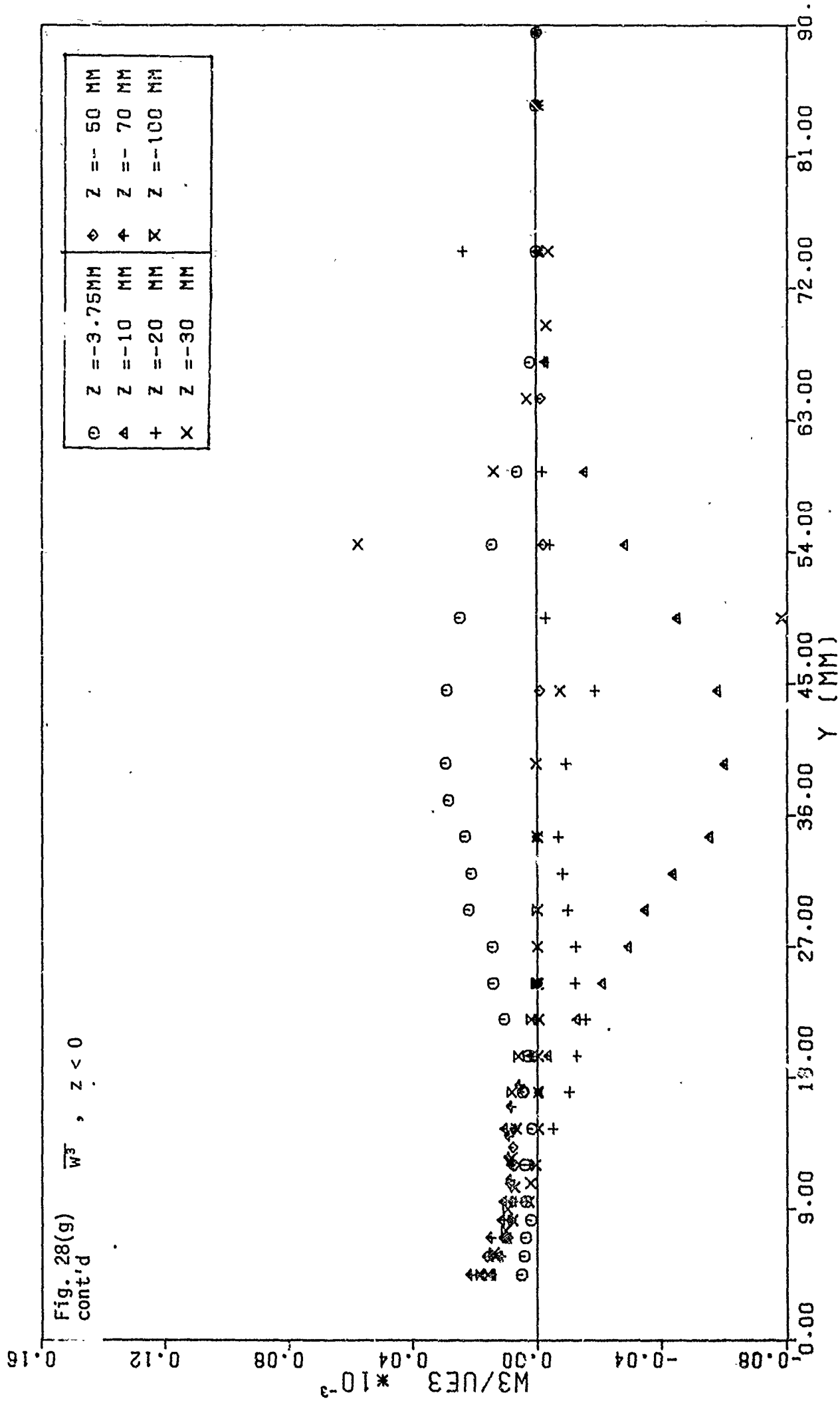






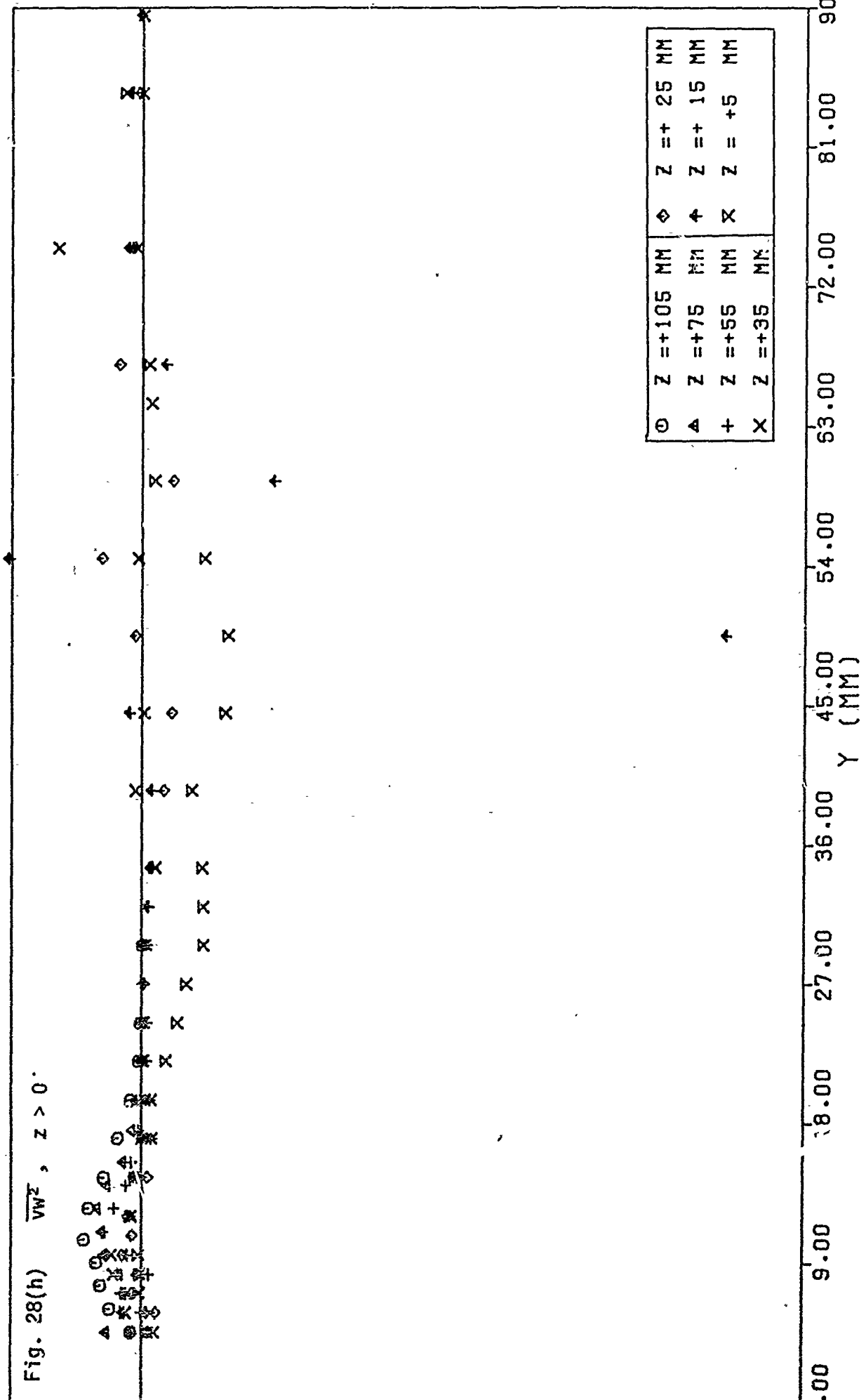






W2V/UE3 \* 10<sup>-3</sup>

Fig. 28(h)  $\overline{vw^2}$ ,  $z > 0$ .



○	Z = +105 MM	◇	Z = +25 MM
△	Z = +75 MM	†	Z = +15 MM
+	Z = +55 MM	×	Z = +5 MM
×	Z = +35 MM		

x

0.03

0.02

0.01

$W2V/UE3 \times 10^{-3}$

-0.02

-0.03

Fig. 28(h)  
cont'd

$\overline{VW^2}$ ,  $z < 0$

○	Z = -3.75MM	◇	Z = -50 MM
△	Z = -10 MM	+	Z = -70 MM
+	Z = -20 MM	x	Z = -100 MM
x	Z = -30 MM		

+

+

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+

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+

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+

+

+

+

+

+

+

+

x

Y (MM)

54.00

63.00

72.00

81.00

90.00

0.24

0.16

0.08

0.00

$V2M/UE3 \times 10^{-4}$

-0.08

-0.16

-0.24

Fig. 28(j)  $\overline{wv^2}$ ,  $z > 0$

⊖	Z = +105 MM	◇	Z = +25 MM
△	Z = +75 MM	+	Z = +15 MM
+	Z = +55 MM	X	Z = +5 MM
X	Z = +35 MM		

+

X

X

X

◇

+

X

X

◇

+

X

X

◇

+

X

X

◇

+

X

X

◇

+

X

X

◇

+

Y (MM)

54.00

63.00

72.00

81.00

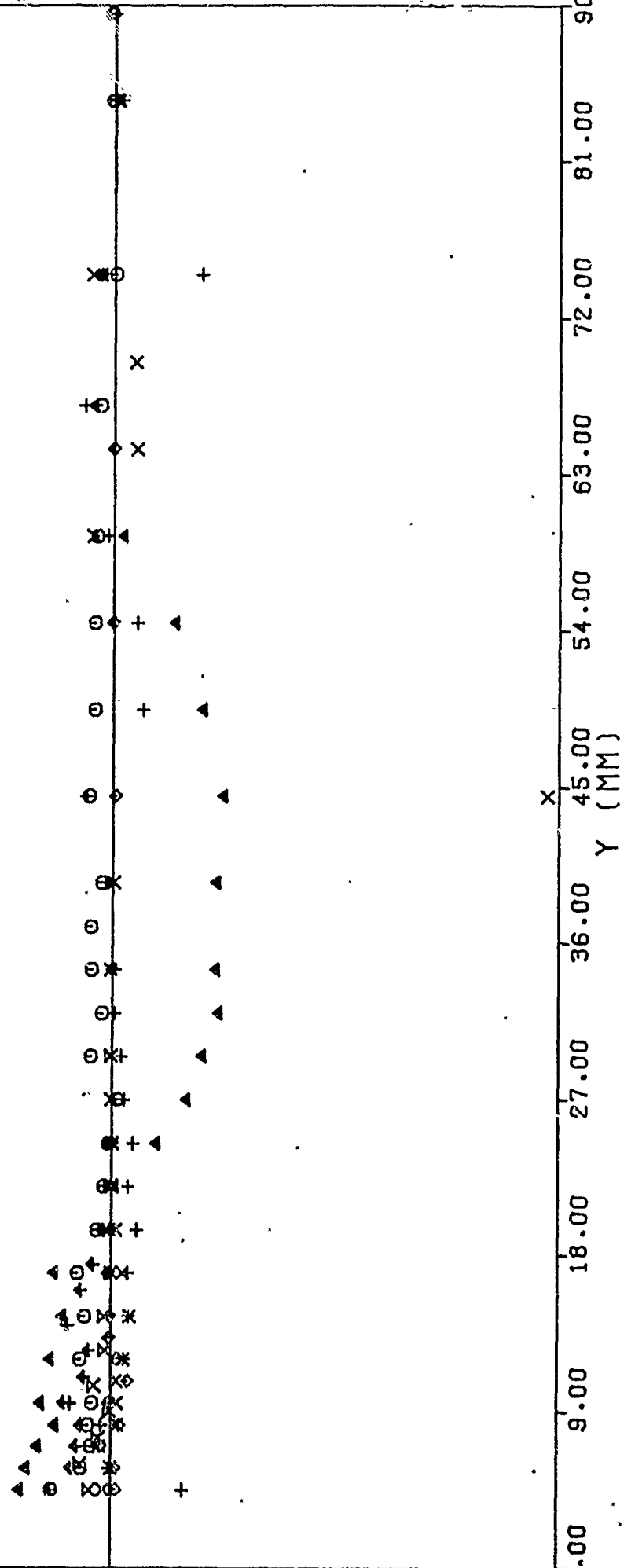
90.00

0.045  
-0.045  
-0.03  
-0.015  
0.00  
0.015  
0.03  
0.045

Fig. 28(j)  
cont'd

$\overline{wv^2}$ ,  $z < 0$

⊖	Z = -3.75 MM	◆	Z = -50 MM
▲	Z = -10 MM	↑	Z = -70 MM
+	Z = -20 MM	×	Z = -100 MM
×	Z = -30 MM		

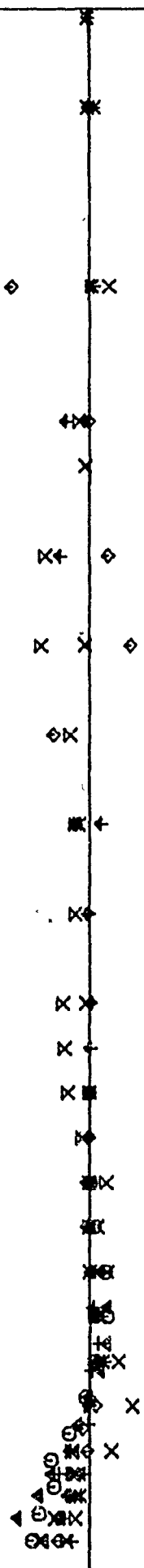


0.045  
0.03  
0.015  
0.00  
-0.015  
-0.03  
-0.045

Fig. 28(k)  $\overline{UVW}$ ,  $z > 0$

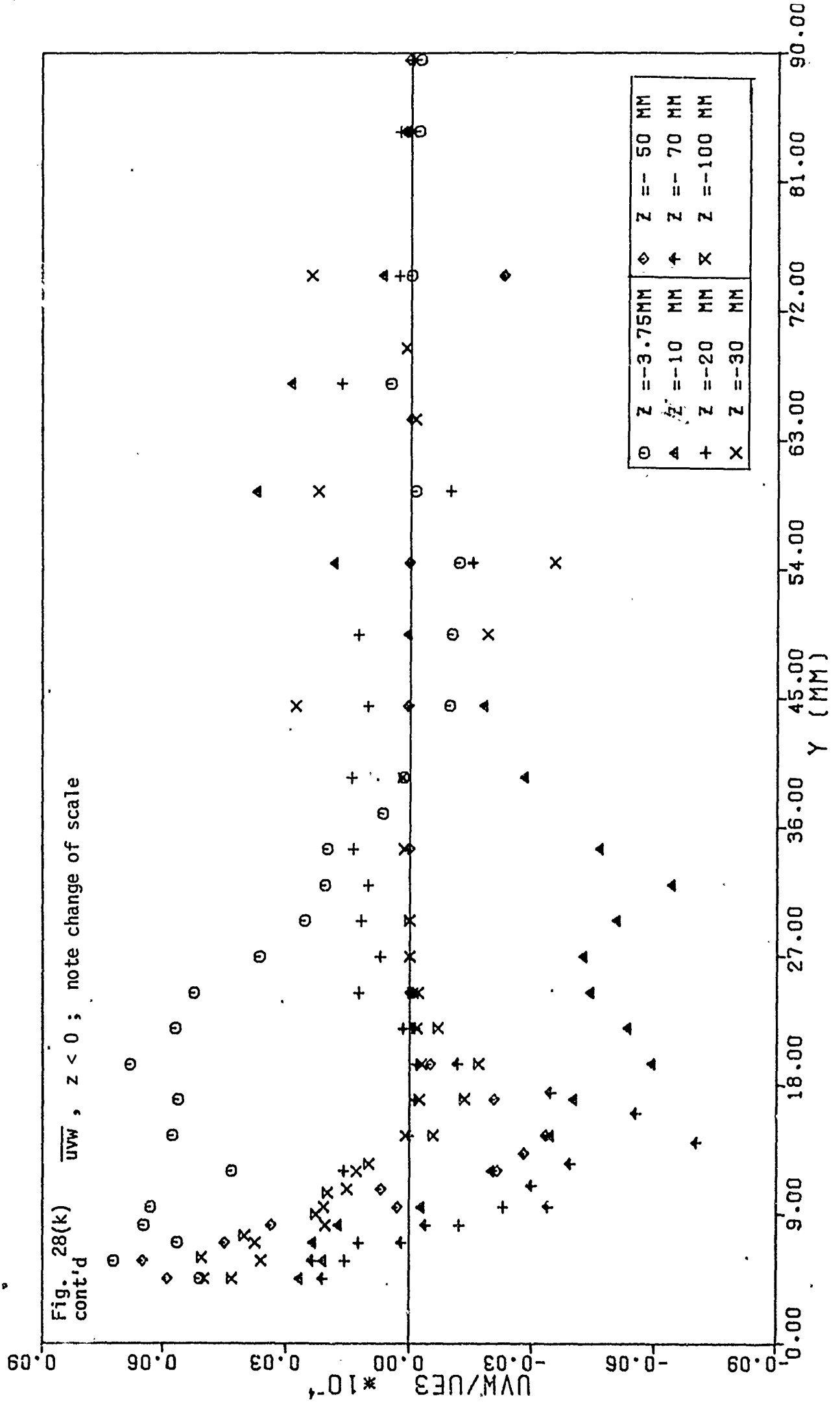
○	Z = +105 MM	◇	Z = + 25 MM
△	Z = +75 MM	↑	Z = + 15 MM
+	Z = +55 MM	×	Z = + 5 MM
×	Z = +35 MM		

↑



Y (MM)

0.00 9.00 18.00 27.00 36.00 45.00 54.00 63.00 72.00 81.00 90.00





3.00

2.25

1.50

SKEW(V)

0.00

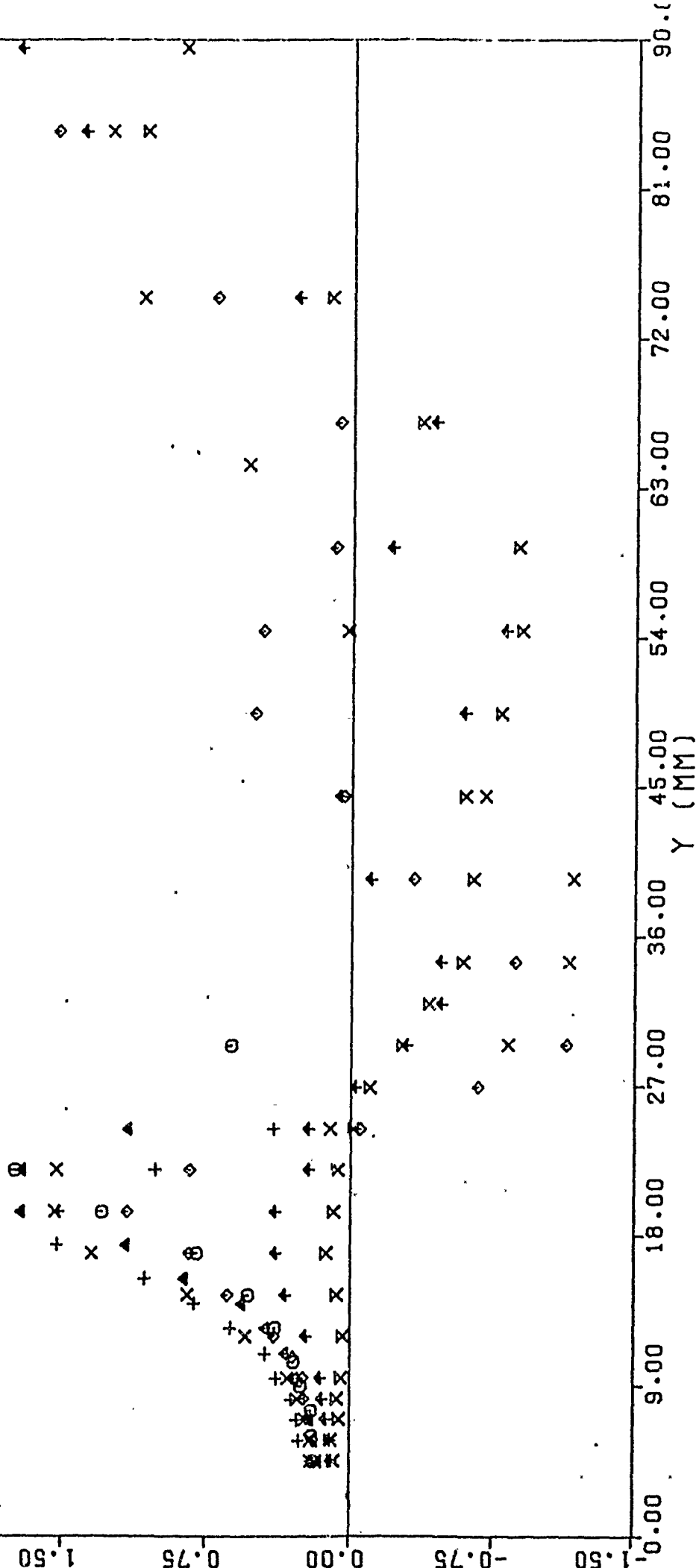
-0.75

-1.50

Fig. 29 Higher-order moments,  $x = 1350 \text{ mm}$

Fig. 29(a) Skewness of  $v$ ,  $\overline{v^3}/(\overline{v^2})^{3/2}$ ,  $z > 0$

○	Z = +105	MM	◇	Z = +25	MM
△	Z = +75	MM	+	Z = +15	MM
+	Z = +55	MM	X	Z = +5	MM
X	Z = +35	MM			



3.00

2.25

1.50

SKREW (V)

0.75

0.00

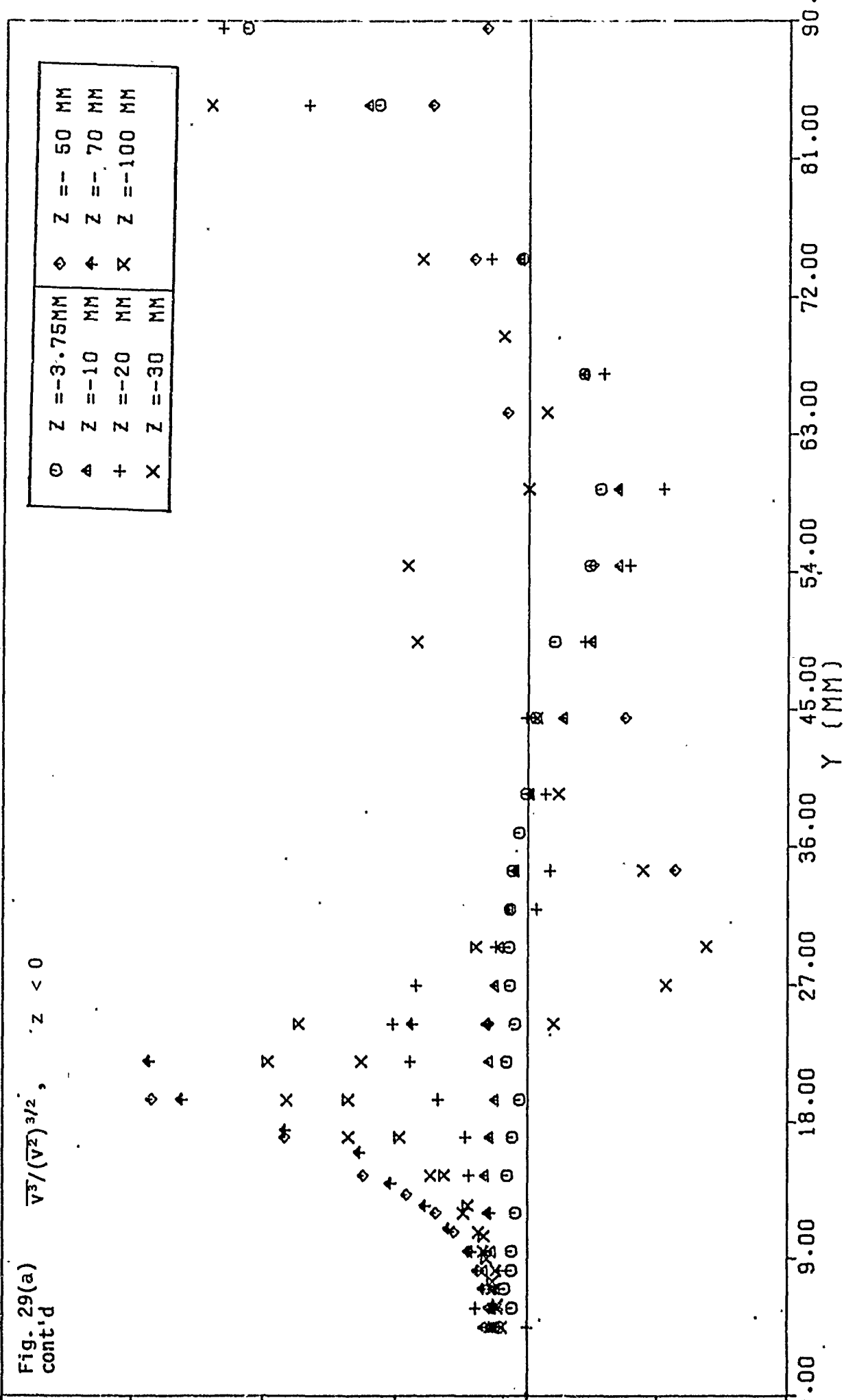
-0.75

-1.50

Fig. 29(a)  
cont'd

$\frac{V^3}{(\sqrt{V^2})^{3/2}}, \quad z < 0$

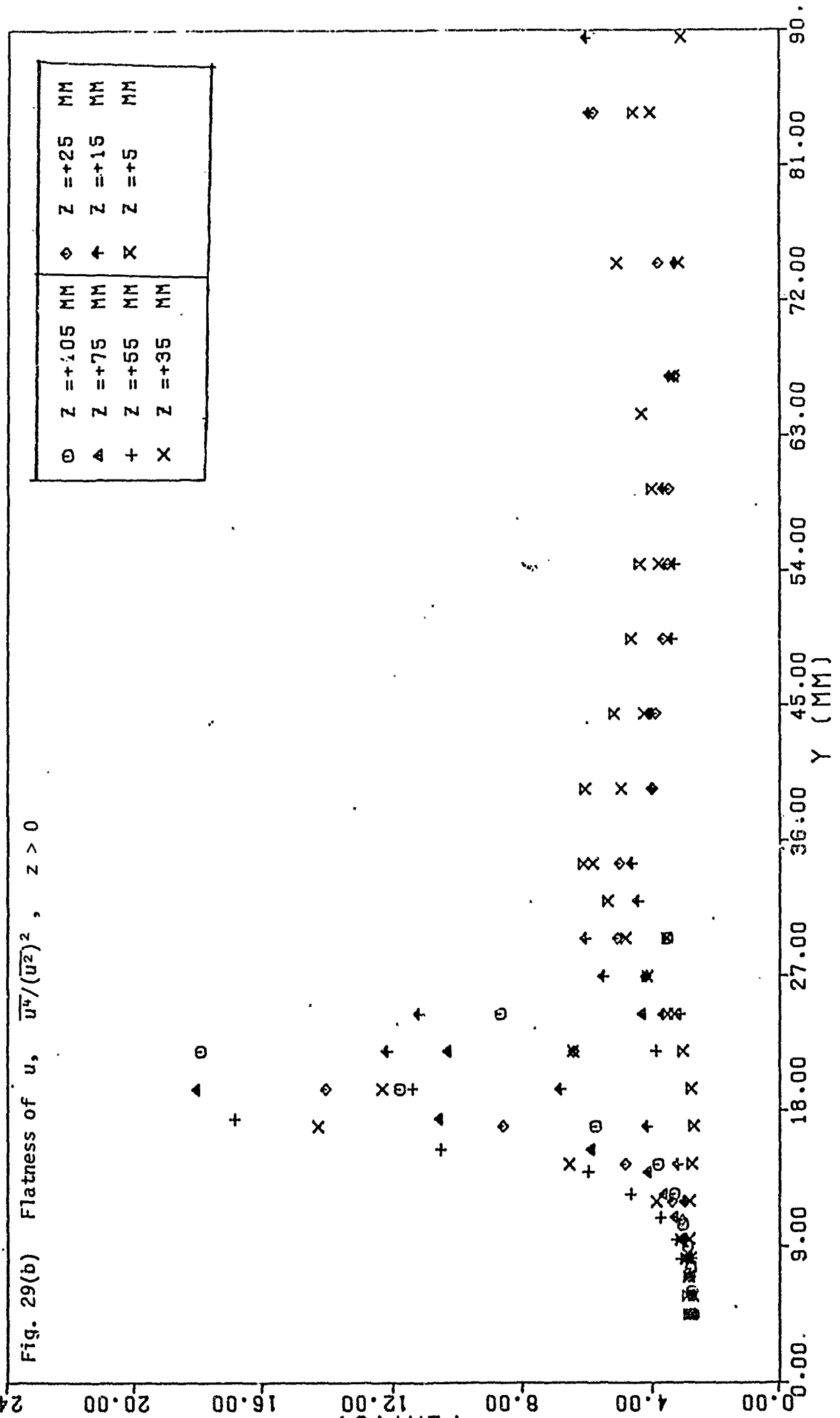
⊖	Z = -3.75 MM	◇	Z = -50 MM
△	Z = -10 MM	+	Z = -70 MM
+	Z = -20 MM	X	Z = -100 MM
X	Z = -30 MM		



FLAT(U)

Fig. 29(b) Flatness of  $u$ ,  $\overline{u^4}/(\overline{u^2})^2$ ,  $z > 0$

$\ominus$	$Z = +105$	MM	$\diamond$	$Z = +25$	MM
$\blacktriangle$	$Z = +75$	MM	$\uparrow$	$Z = +15$	MM
$+$	$Z = +55$	MM	$\times$	$Z = +5$	MM
$\times$	$Z = +35$	MM			



24.00  
20.00  
16.00  
12.00  
8.00  
4.00  
0.00

FLAT(U)

Fig. 29(b)

cont'd  $\overline{u^4}/(\overline{u^2})^2, z < 0$

○	Z = -3.75MM	◇	Z = -50 MM
△	Z = -10 MM	+	Z = -70 MM
+	Z = -20 MM	X	Z = -100 MM
X	Z = -30 MM		

6

Y (MM)

0.00 9.00 18.00 27.00 36.00 45.00 54.00 63.00 72.00 81.00 90.00

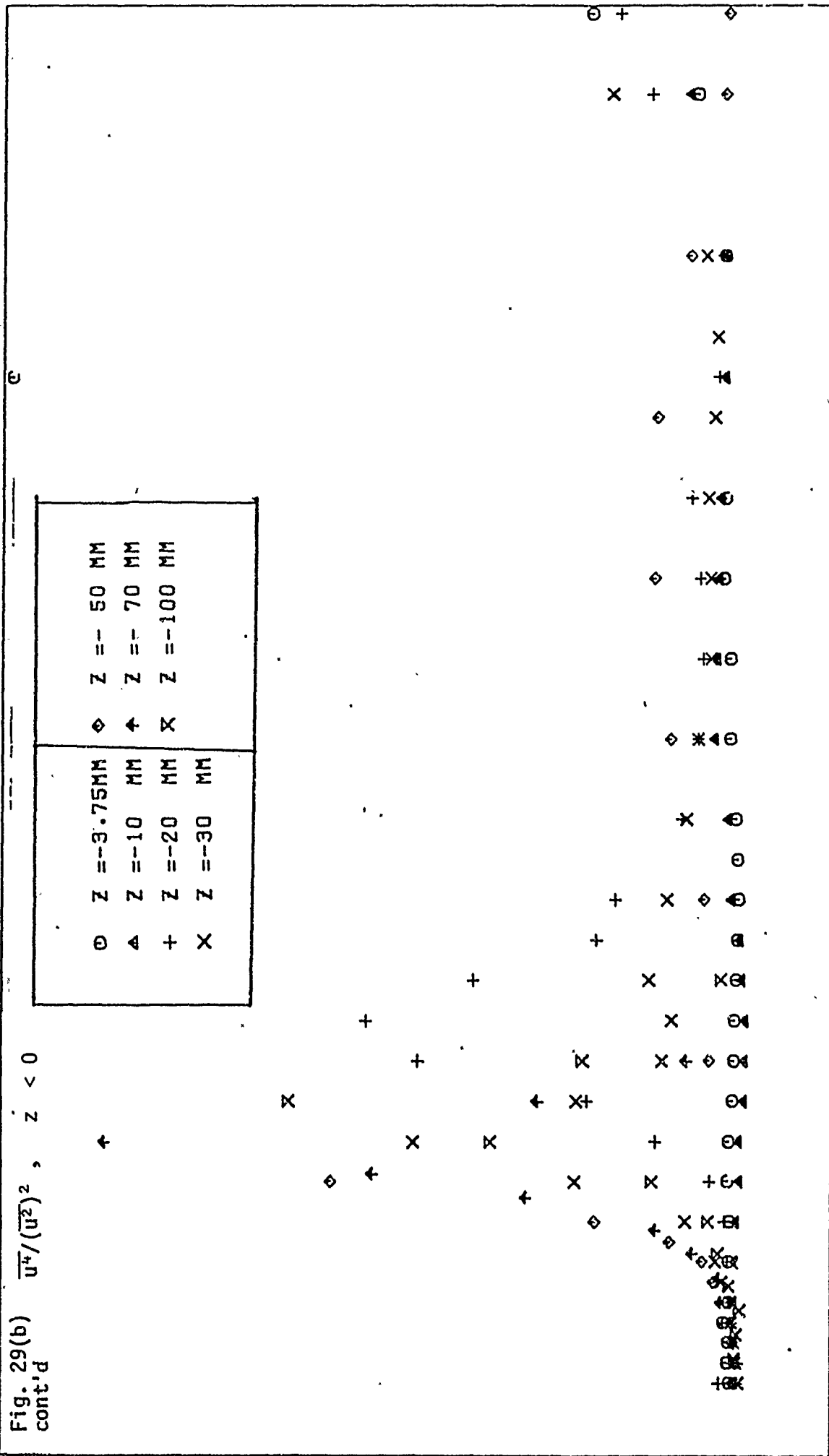


Fig. 30(a) Mean temperature profiles,  $x = 1350$  mm

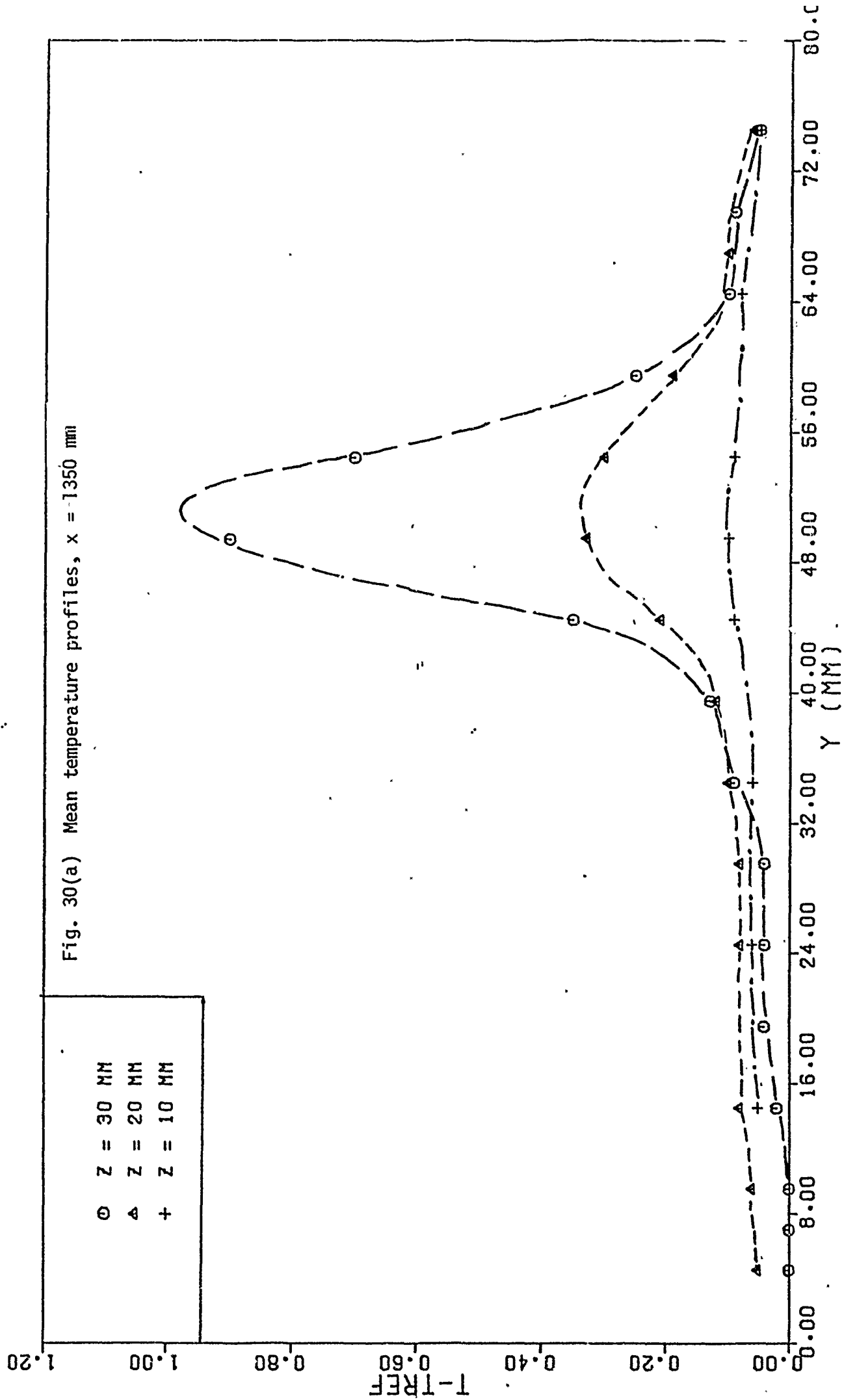


Fig. 30(b) Intermittency profile at  $z = 30$  mm,  $x = 1350$  mm

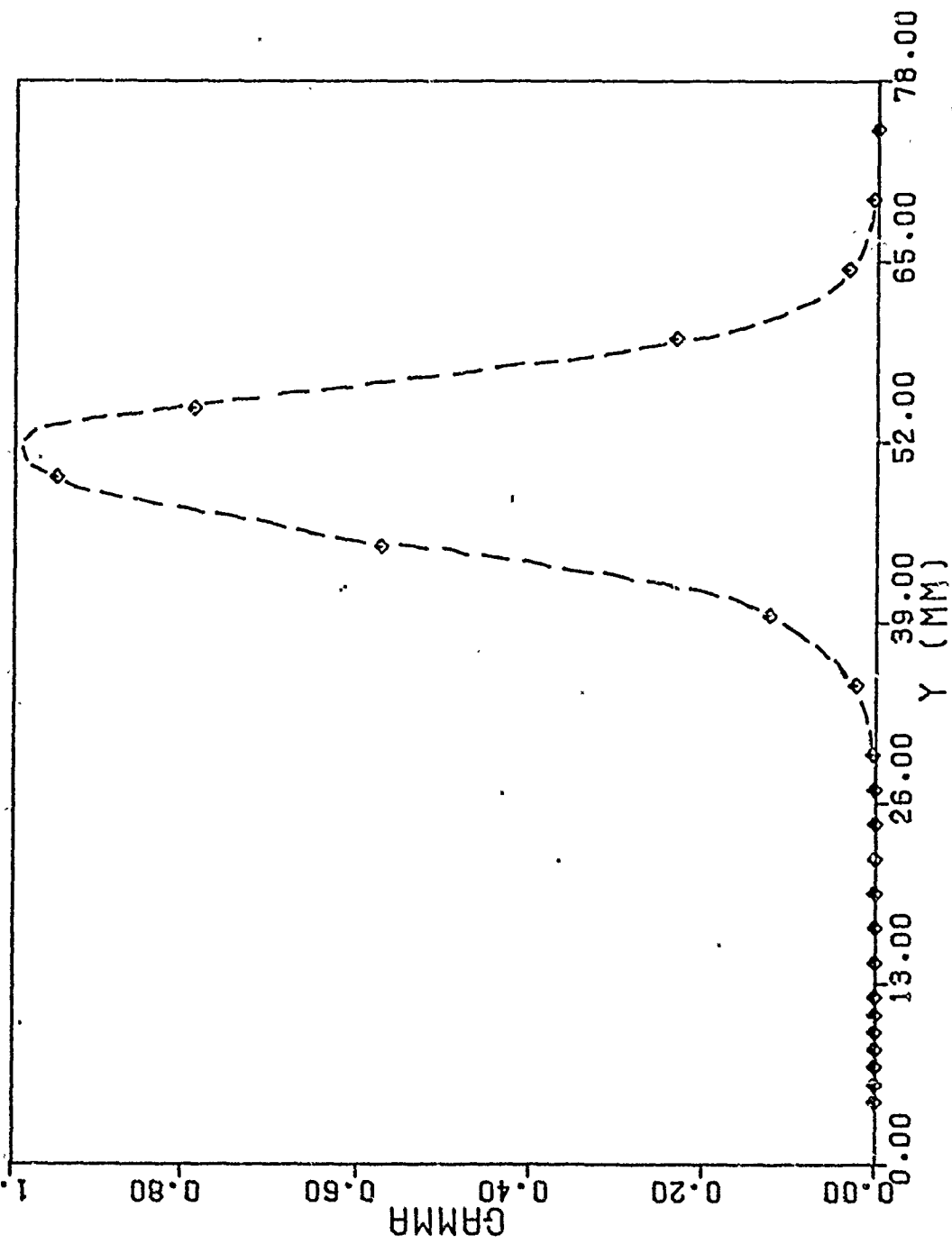


Fig. 31 Velocity contours in double vortex, "common flow" downwards

Fig. 31(a) x = 900 mm

⊖	U/UE = .60	⊕	U/UE = .90
△	U/UE = .70	⊗	U/UE = .95
+	U/UE = .75	Z	U/UE = .975
X	U/UE = .80	Y	U/UE = .995
◇	U/UE = .85		

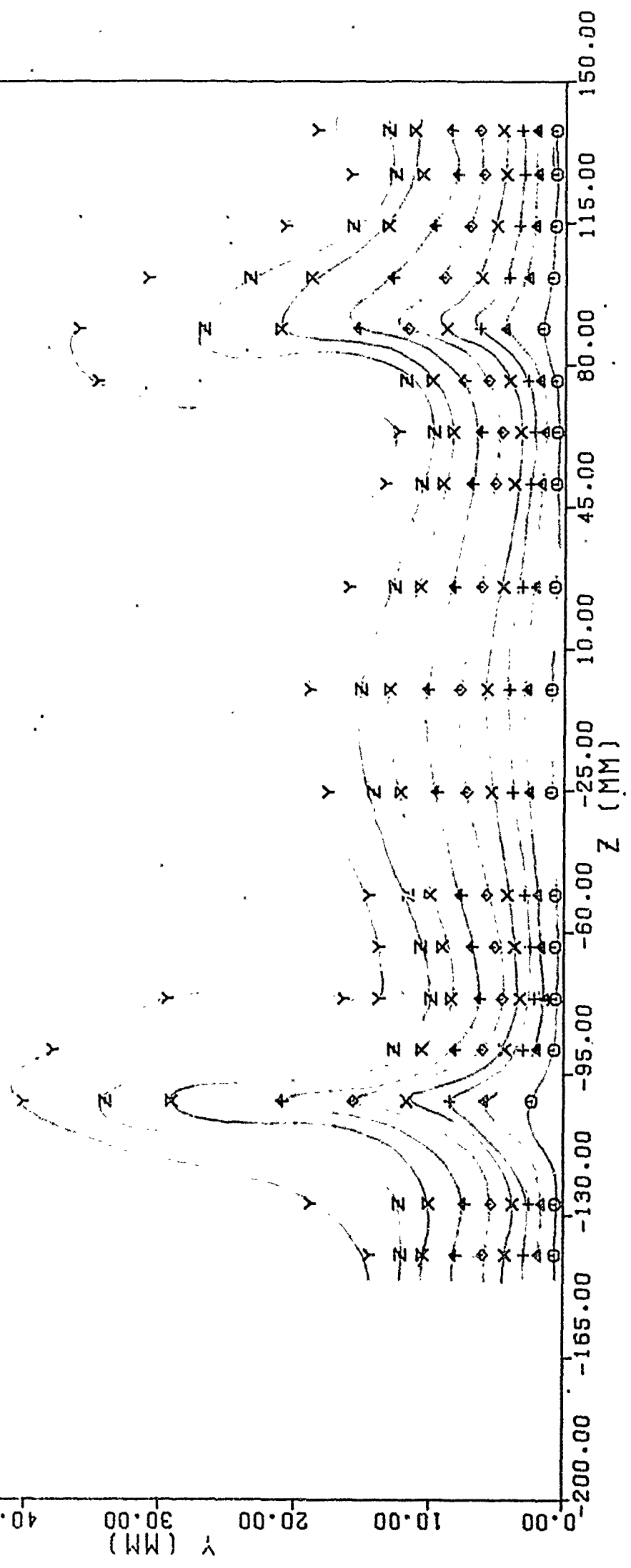
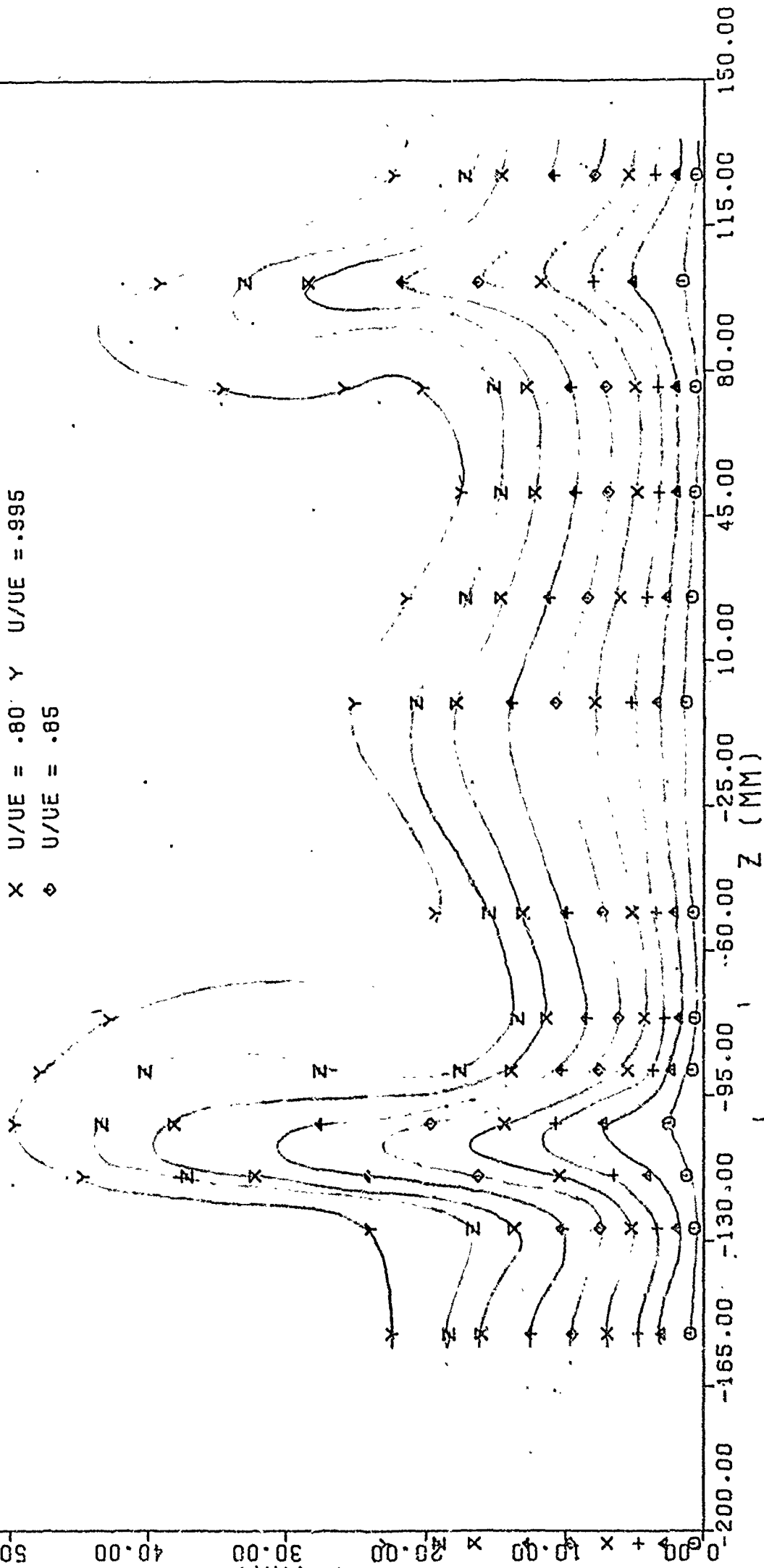


Fig. 31(b)  $x = 1350 \text{ mm}$

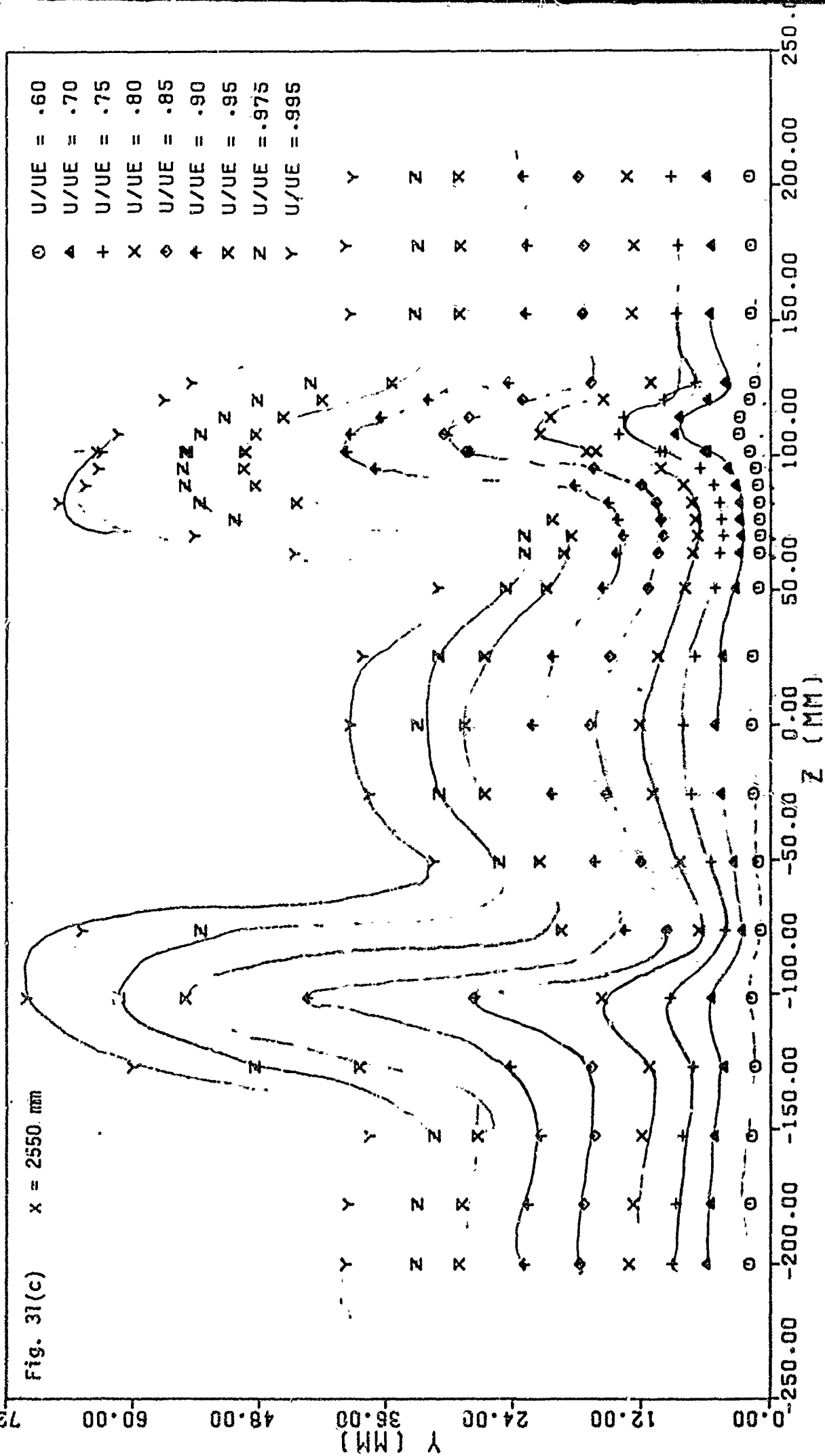
$\ominus$	$U/UE = .60$	$\blacktriangle$	$U/UE = .90$
$\triangle$	$U/UE = .70$	$\times$	$U/UE = .95$
$+$	$U/UE = .75$	$z$	$U/UE = .975$
$\times$	$U/UE = .80$	$y$	$U/UE = .995$
$\diamond$	$U/UE = .85$		





72.00

Fig. 31(c)  $x = 2550 \text{ mm}$



0.00

12.00

24.00

36.00

48.00

60.00

72.00

84.00

96.00

108.00

120.00

132.00

144.00

156.00

168.00

180.00

192.00

204.00

216.00

228.00

240.00

252.00

264.00

276.00

288.00

300.00

312.00

324.00

336.00

348.00

360.00

372.00

384.00

396.00

408.00

420.00

432.00

444.00

456.00

468.00

480.00

492.00

504.00

516.00

528.00

540.00

552.00

564.00

576.00

588.00

600.00

612.00

624.00

636.00

648.00

660.00

672.00

684.00

696.00

708.00

720.00

732.00

744.00

756.00

768.00

780.00

792.00

804.00

816.00

828.00

840.00

852.00

864.00

876.00

888.00

900.00

912.00

924.00

936.00

948.00

960.00

972.00

984.00

996.00

1008.00

1020.00

1032.00

1044.00

1056.00

1068.00

1080.00

1092.00

1104.00

1116.00

1128.00

1140.00

1152.00

1164.00

1176.00

1188.00

1200.00

1212.00

1224.00

1236.00

1248.00

1260.00

1272.00

1284.00

1296.00

1308.00

1320.00

1332.00

1344.00

1356.00

1368.00

1380.00

1392.00

1404.00

1416.00

1428.00

1440.00

1452.00

1464.00

1476.00

1488.00

1500.00

1512.00

1524.00

1536.00

1548.00

1560.00

1572.00

1584.00

1596.00

1608.00

1620.00

1632.00

1644.00

1656.00

1668.00

1680.00

1692.00

1704.00

1716.00

1728.00

1740.00

1752.00

1764.00

1776.00

1788.00

1800.00

1812.00

1824.00

1836.00

1848.00

1860.00

1872.00

1884.00

1896.00

1908.00

1920.00

1932.00

1944.00

1956.00

1968.00

1980.00

1992.00

2004.00

2016.00

2028.00

2040.00

2052.00

2064.00

2076.00

2088.00

2100.00

2112.00

2124.00

2136.00

2148.00

2160.00

2172.00

2184.00

2196.00

2208.00

2220.00

2232.00

2244.00

2256.00

2268.00

2280.00

2292.00

2304.00

2316.00

2328.00

2340.00

2352.00

2364.00

2376.00

2388.00

2400.00

2412.00

2424.00

2436.00

2448.00

2460.00

2472.00

2484.00

2496.00

2508.00

2520.00

2532.00

2544.00

2556.00

2568.00

2580.00

2592.00

2604.00

2616.00

2628.00

2640.00

2652.00

2664.00

2676.00

2688.00

2700.00

2712.00

2724.00

2736.00

2748.00

2760.00

2772.00

2784.00

2796.00

2808.00

2820.00

2832.00

2844.00

2856.00

2868.00

2880.00

2892.00

2904.00

2916.00

2928.00

2940.00

2952.00

2964.00

2976.00

2988.00

3000.00

3012.00

3024.00

3036.00

3048.00

3060.00

3072.00

3084.00

3096.00

3108.00

3120.00

3132.00

3144.00

3156.00

3168.00

3180.00

3192.00

3204.00

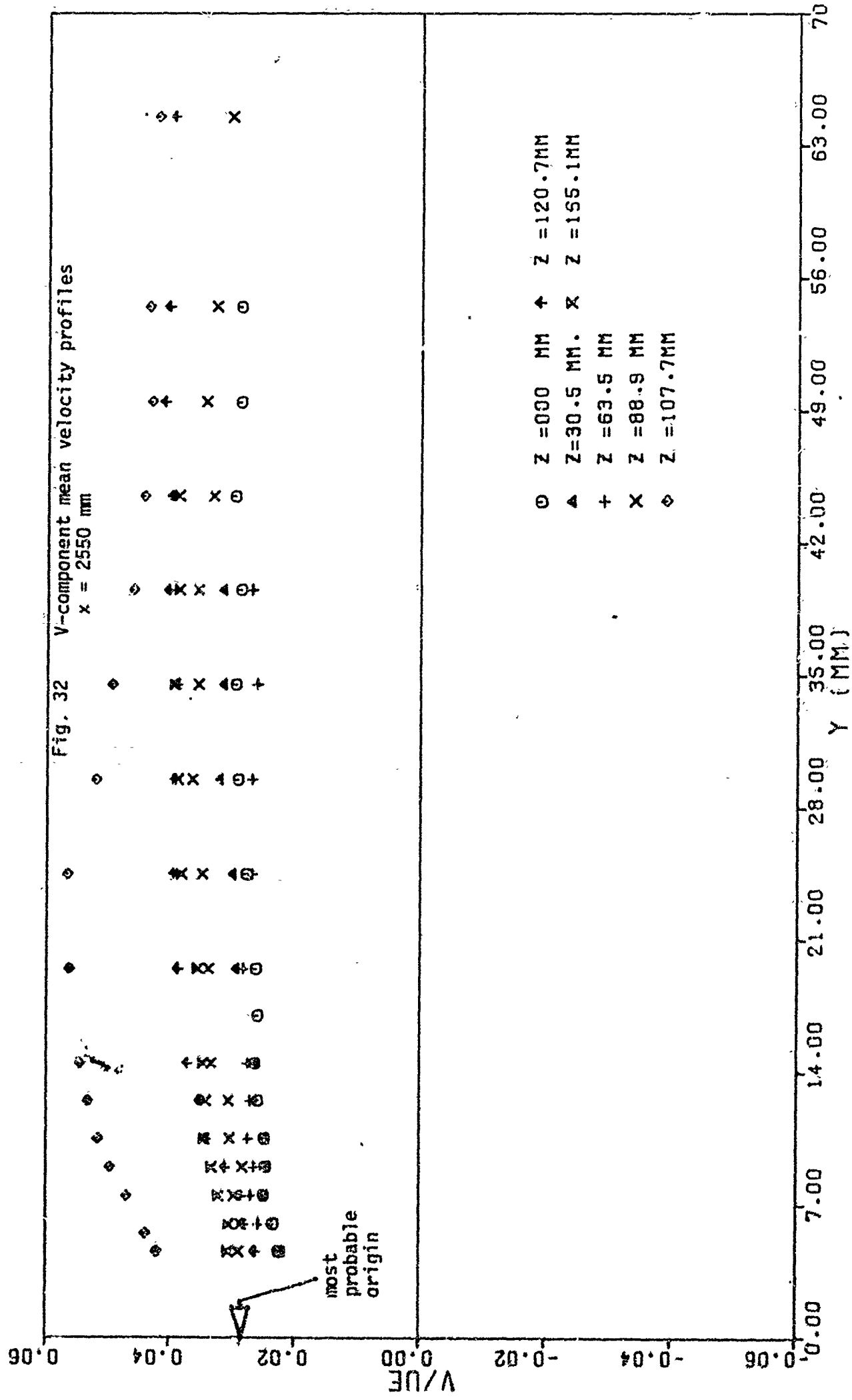
3216.00

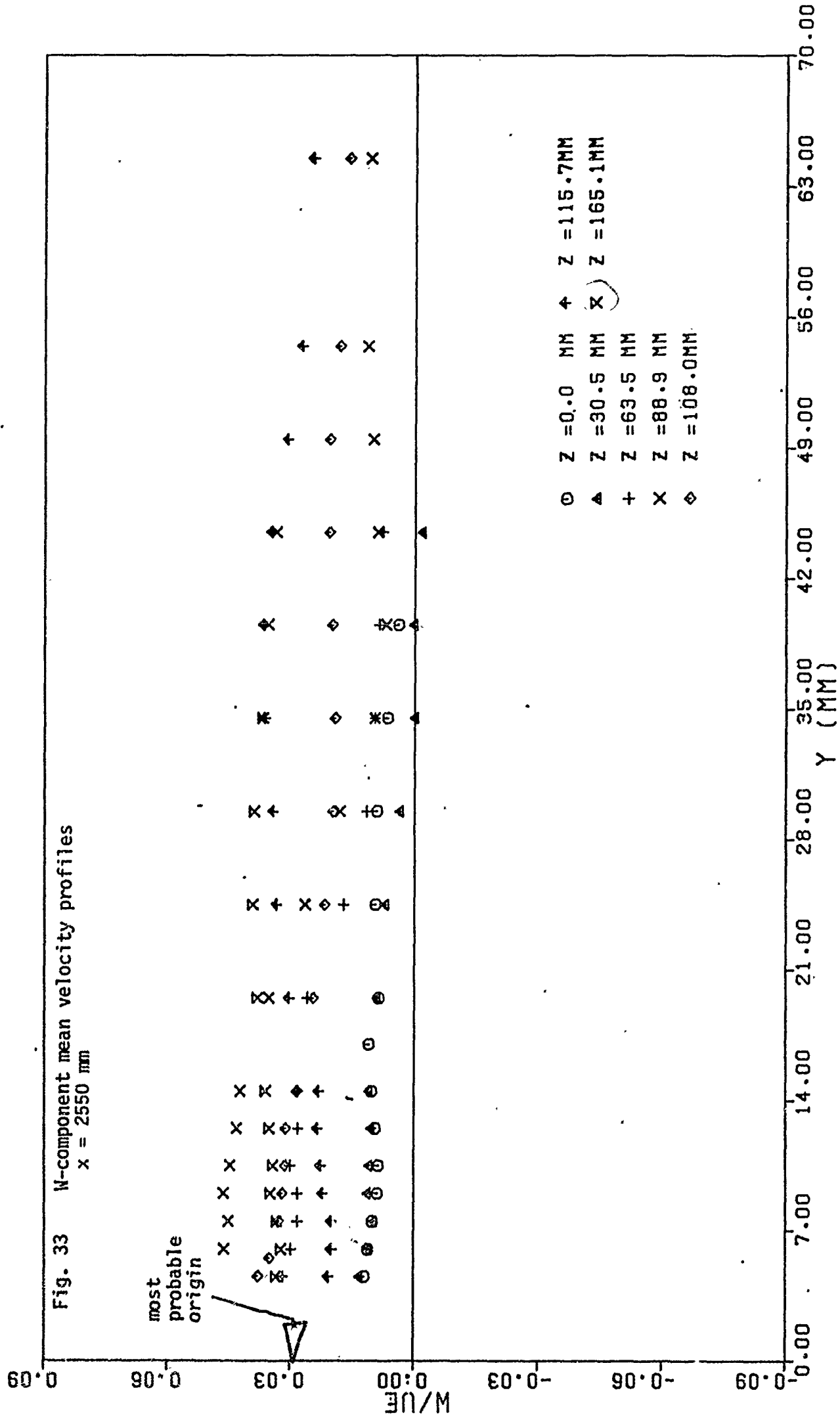
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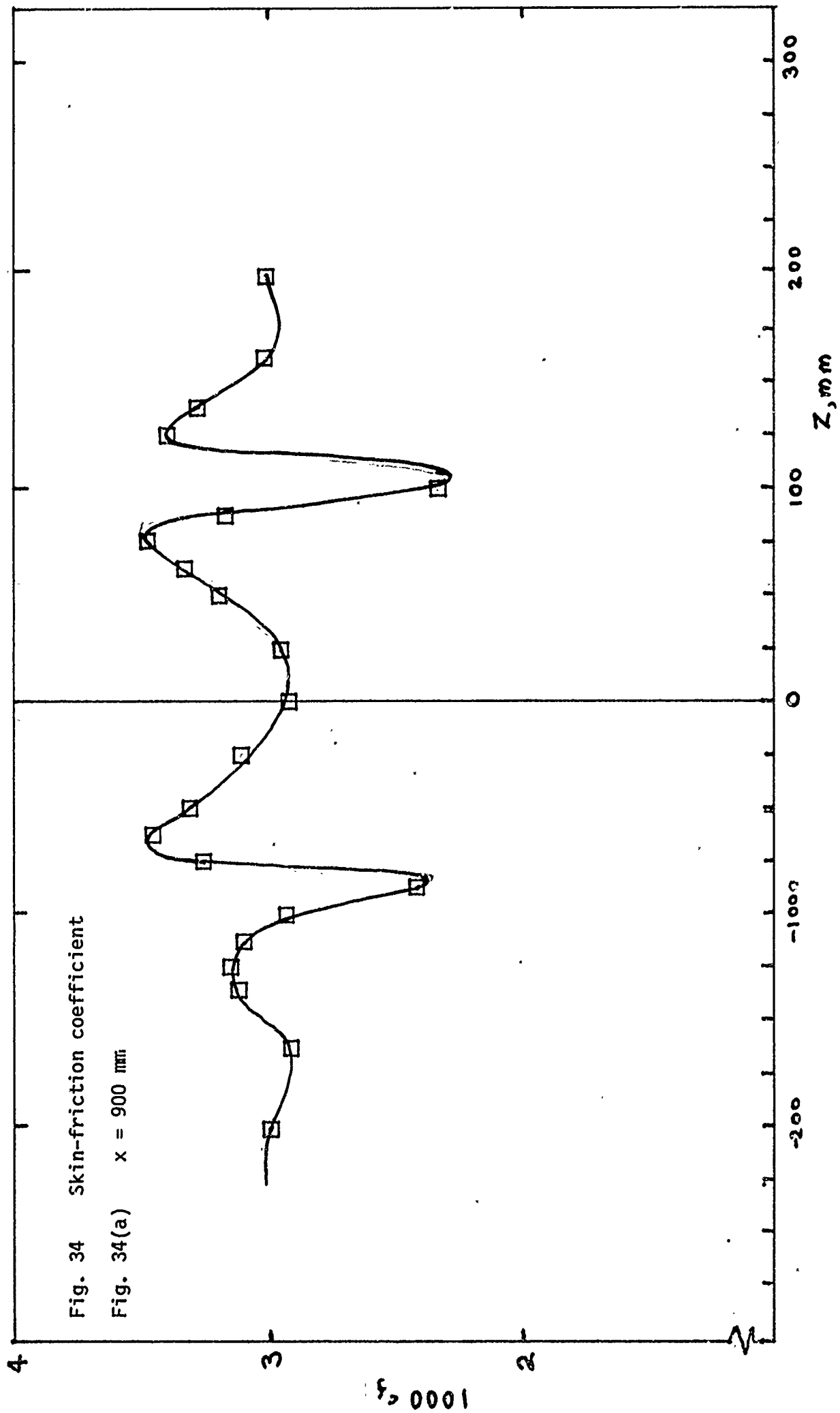
3240.00

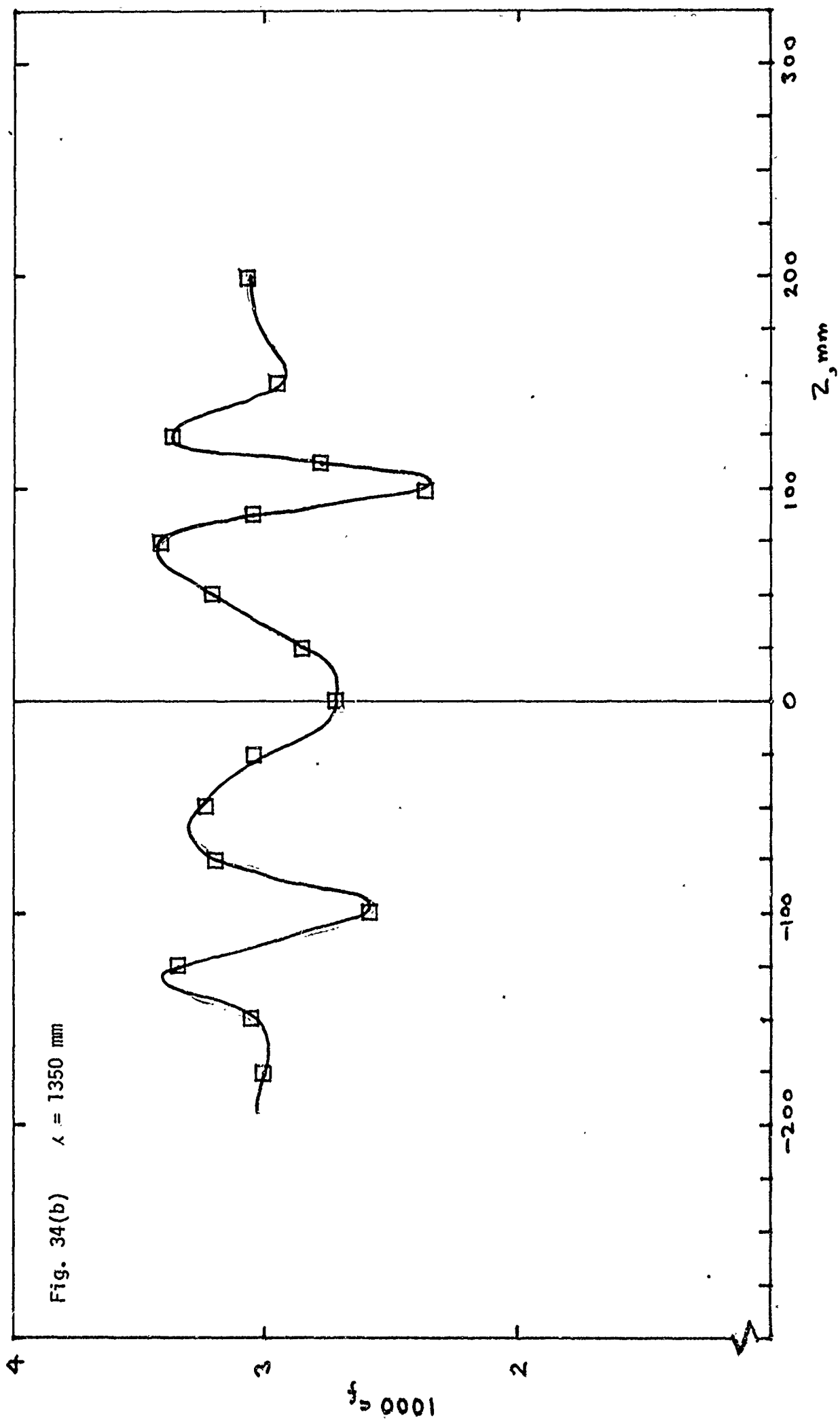
3252.00

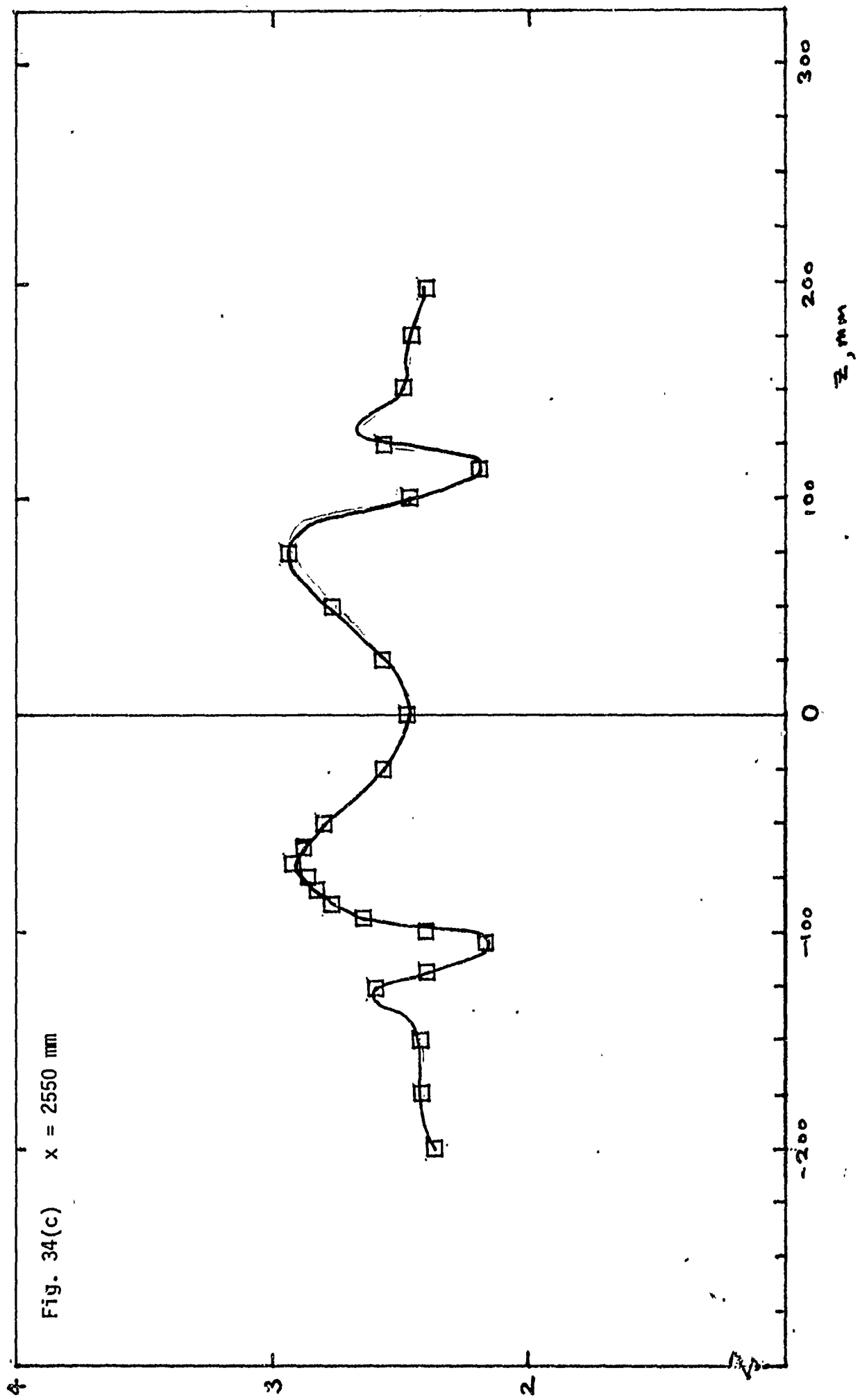
32











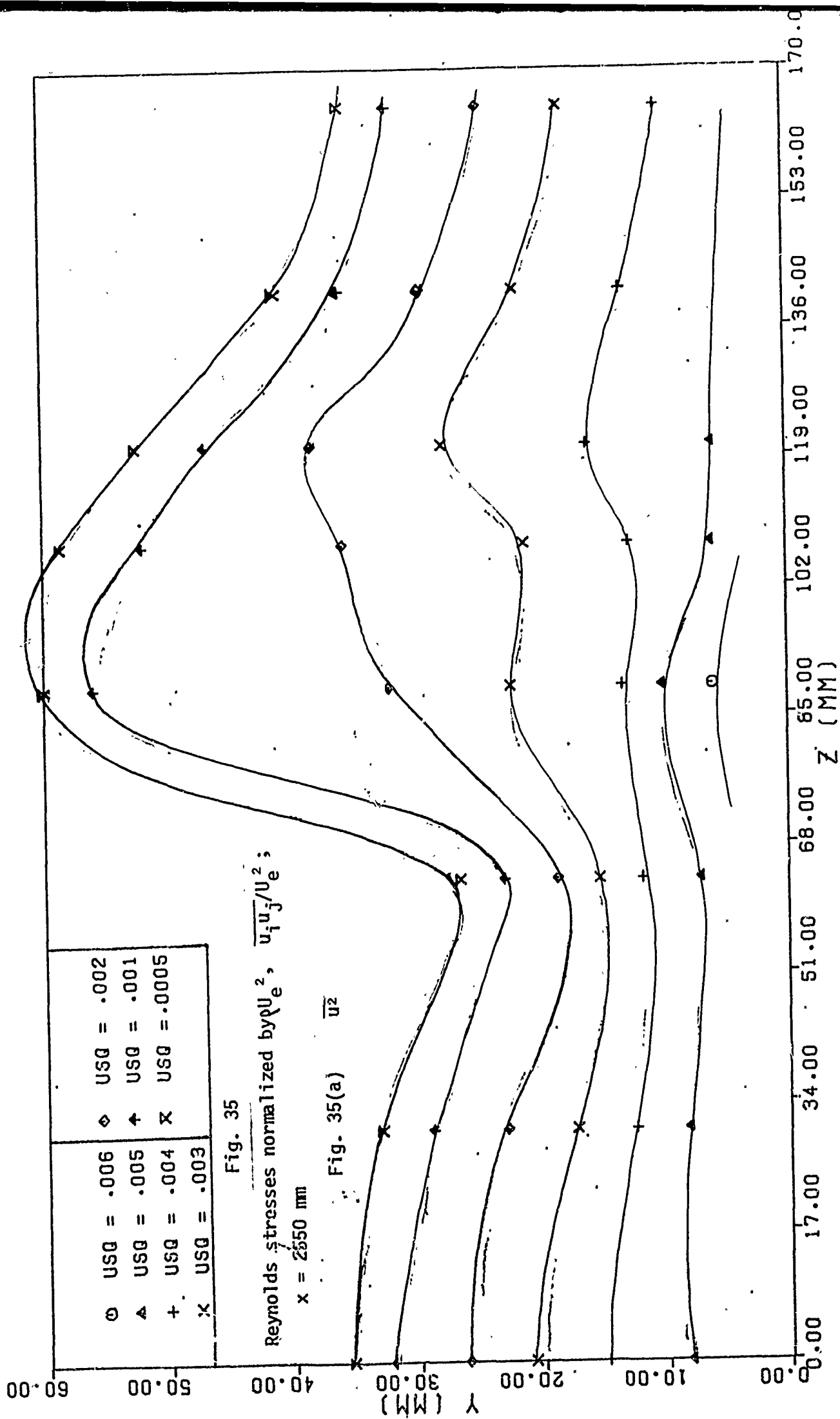
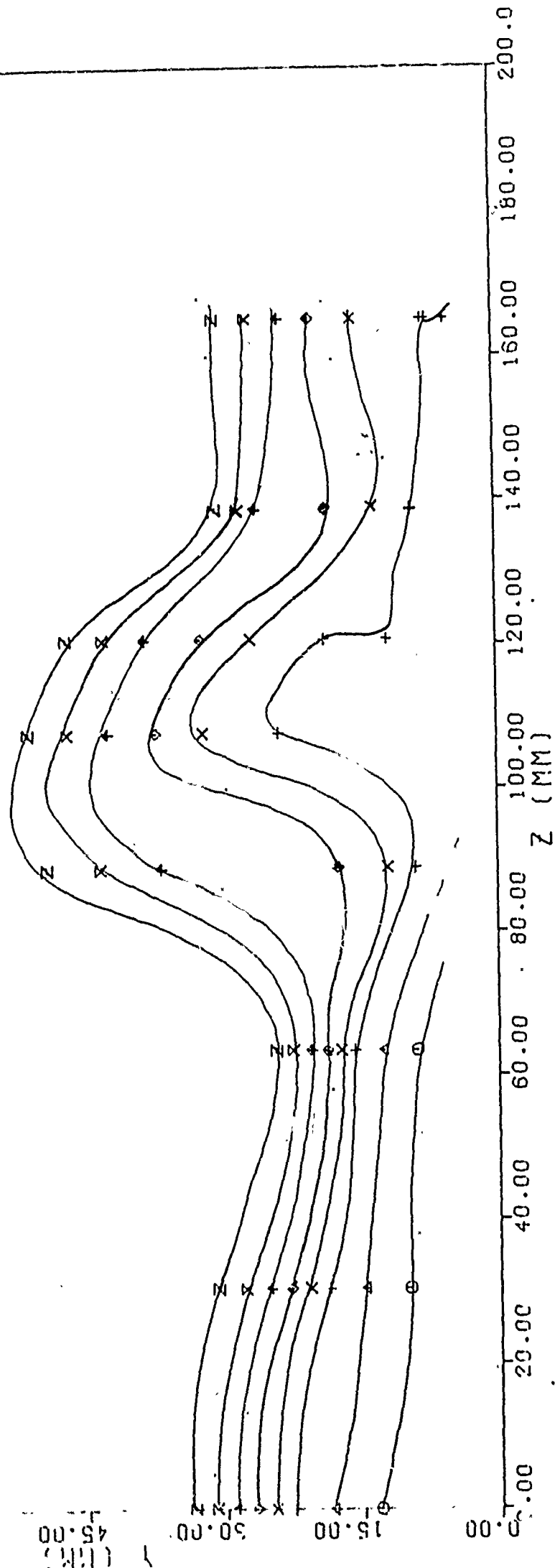


Fig. 35(b)  $\sqrt{V^2}$

○	VSQ= .0012	◇	VSQ= .0006
△	VSQ= .0010	+	VSQ= .0005
+	VSQ= .0008	×	VSQ= .0004
×	VSQ= .0007	Z	VSQ= .0003



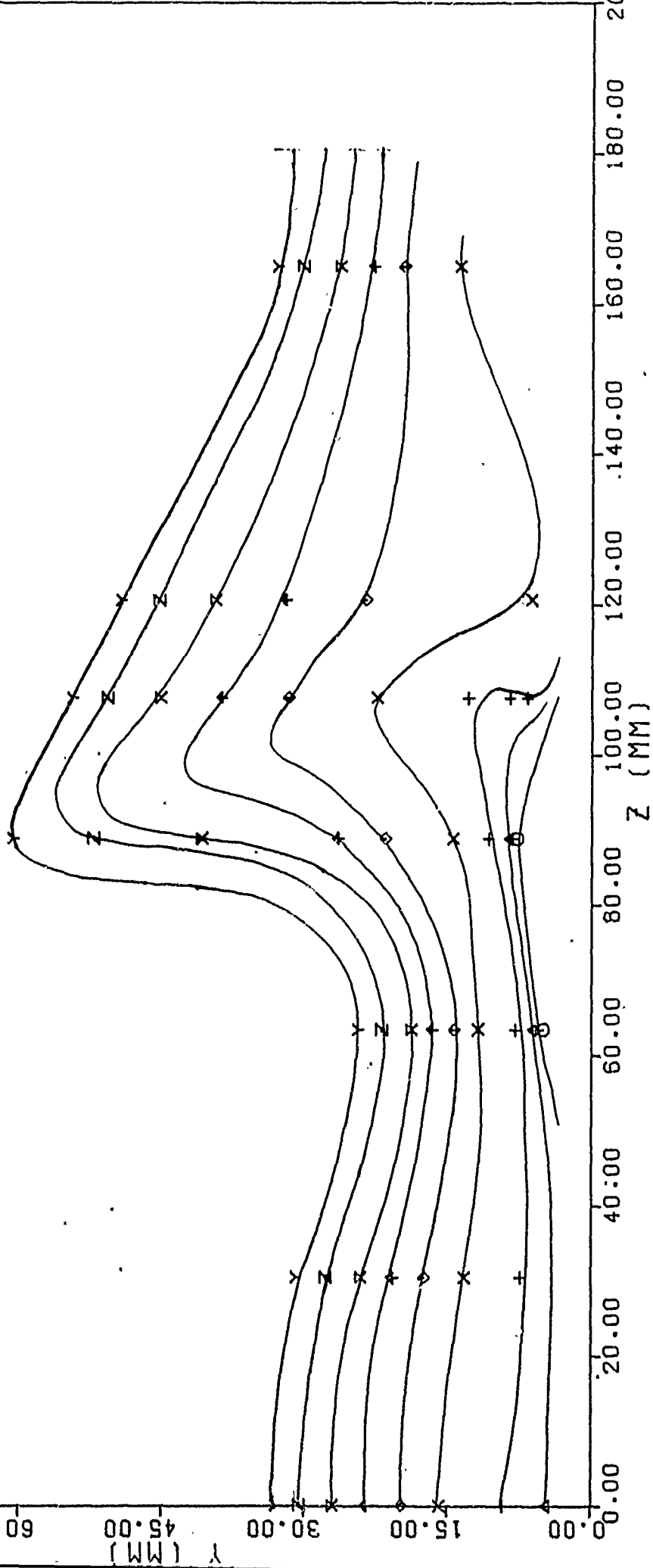


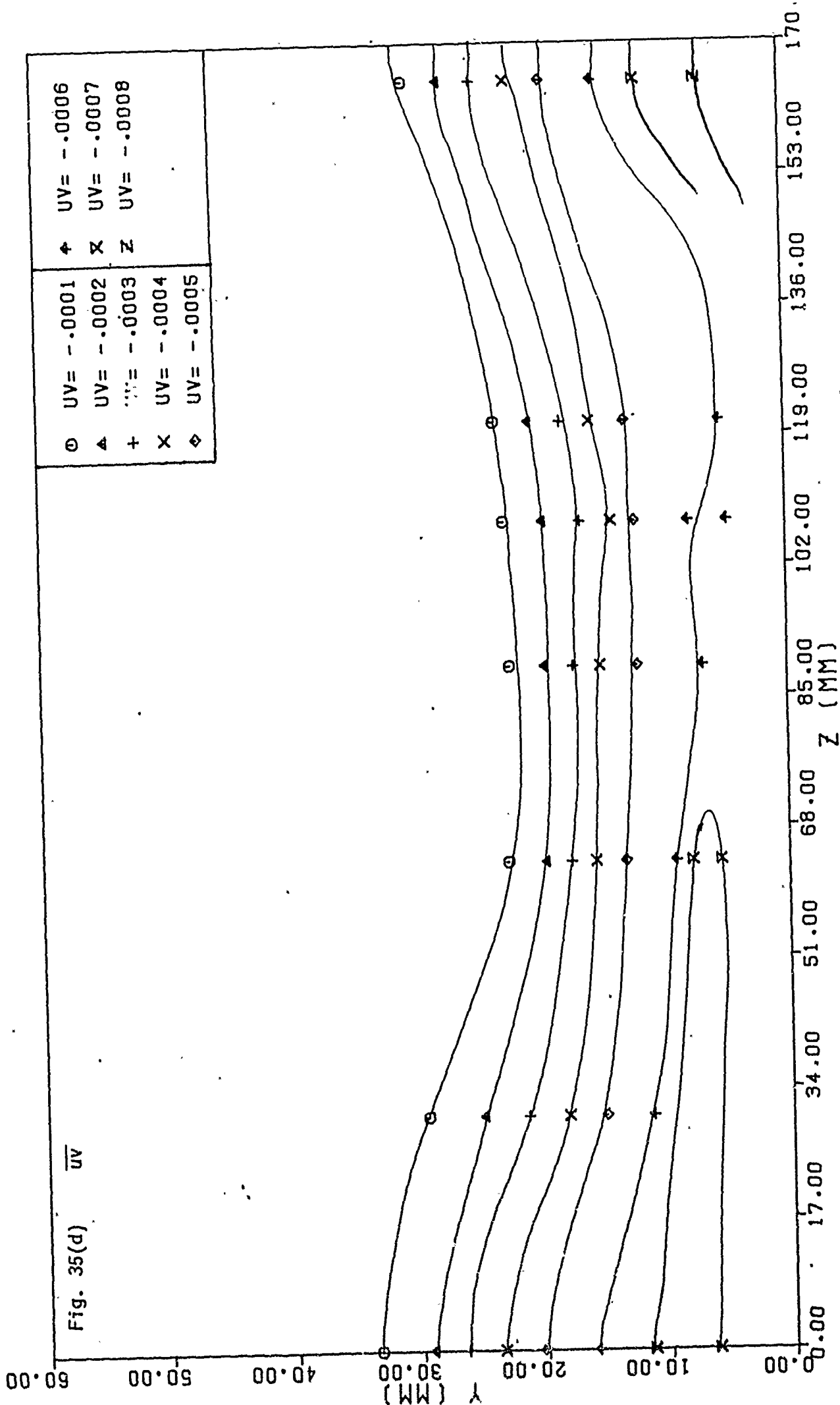
Y (MM) 90.00 75.00 60.00 45.00 30.00 15.00 0.00

Fig. 35(c)

$\overline{w^2}$

○	WSQ= .0024	↑	WSQ= .0012
△	WSQ= .0023	×	WSQ= .0009
+	WSQ= .0021	z	WSQ= .0006
×	WSQ= .0018	Y	WSQ= .0004
◇	WSQ= .0015		





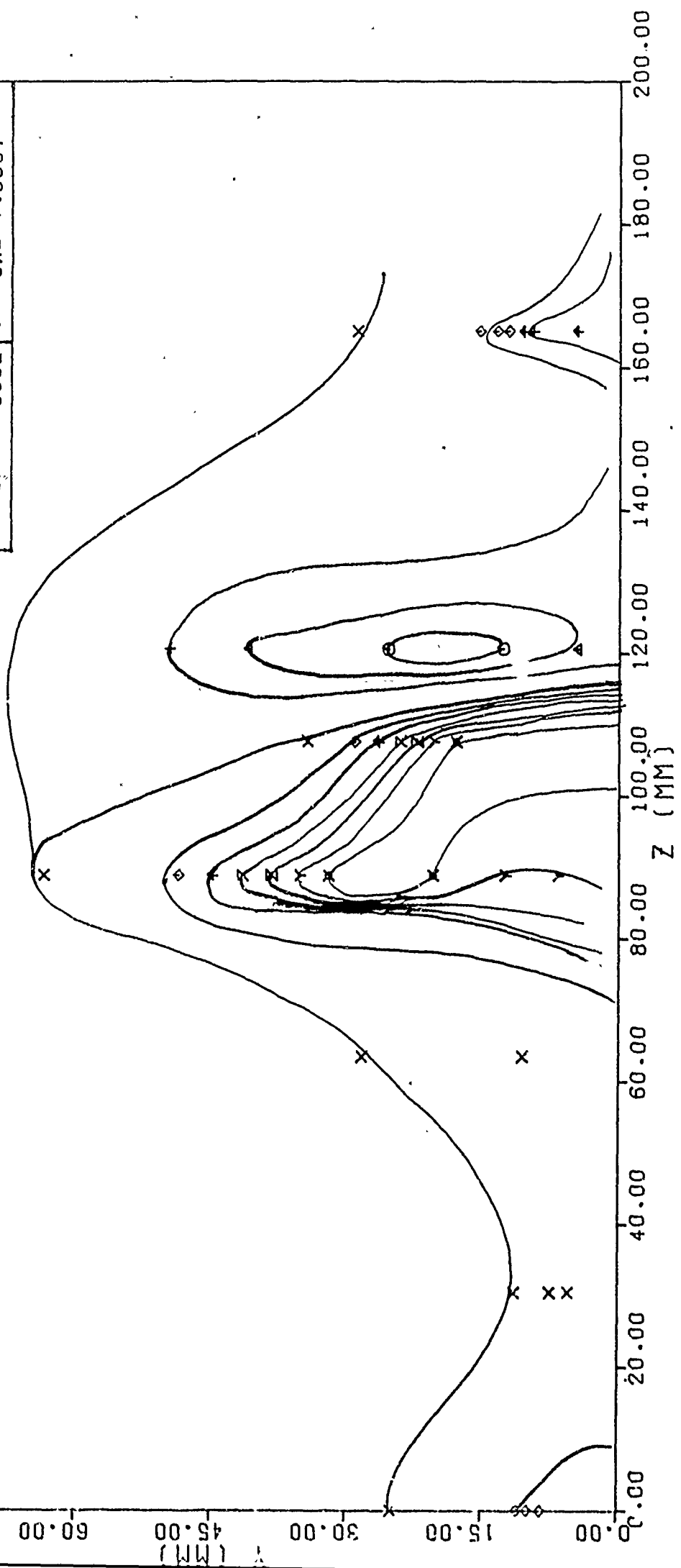
last sl.

90.00  
75.00  
60.00  
45.00  
30.00  
15.00  
0.00

Fig. 35(e)

$\overline{uw}$

$\ominus$	$UW = -.0006$	$+$	$UW = +.0003$
$\Delta$	$UW = -.0004$	$\times$	$UW = +.0004$
$+$	$UW = -.0002$	$z$	$UW = +.0005$
$\times$	$UW = 0.0000$	$y$	$UW = +.0006$
$\diamond$	$UW = +.0002$	$\nabla$	$UW = +.0007$



90.00

Fig. 35(f)

$\overline{VW}$

75.00

60.00

Y (MM)

45.00

30.00

15.00

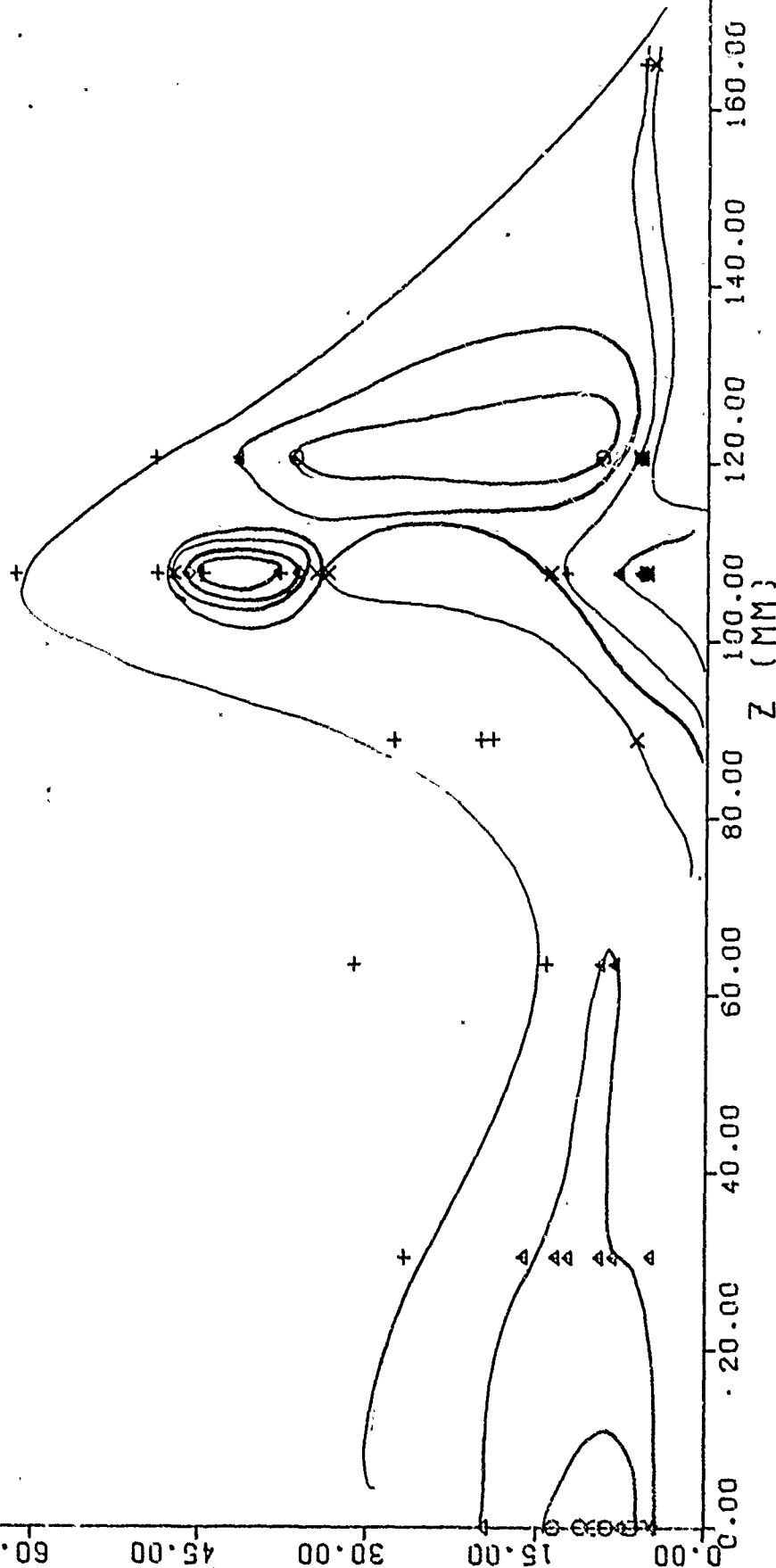
0.00

VW= -.0001  
 VW= -.0002  
 VW= +.0002  
 VW= +.0003  
 VW= +.0003

+  
 X  
 Z  
 Y  
 X

VW= -.0001  
 VW= -.00005  
 VW= 0.0  
 VW= +.00005  
 VW= +.0001

⊖  
 △  
 +  
 X  
 ⊙



0.00

20.00

40.00

60.00

80.00

100.00

120.00

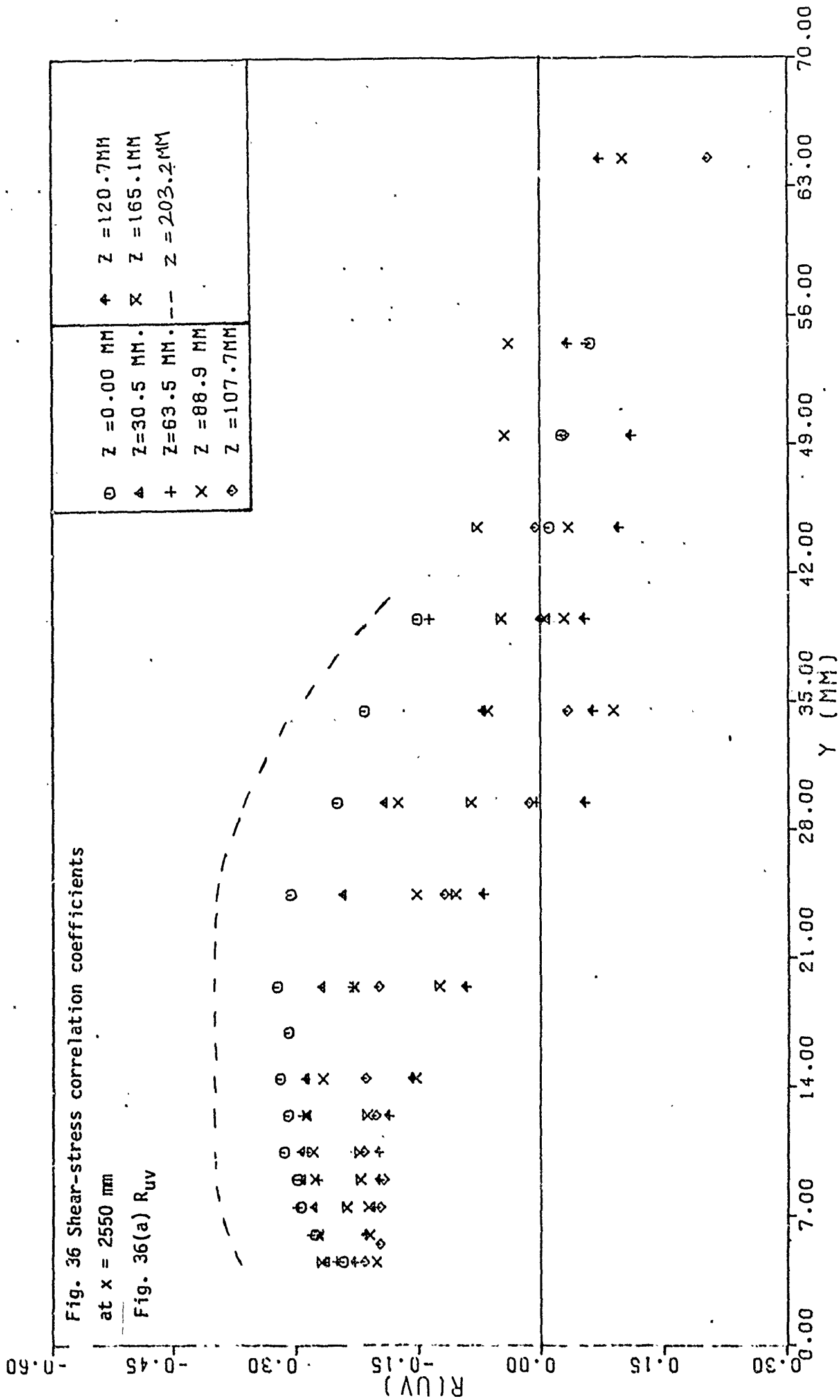
140.00

160.00

180.00

200.00

Z (MM)



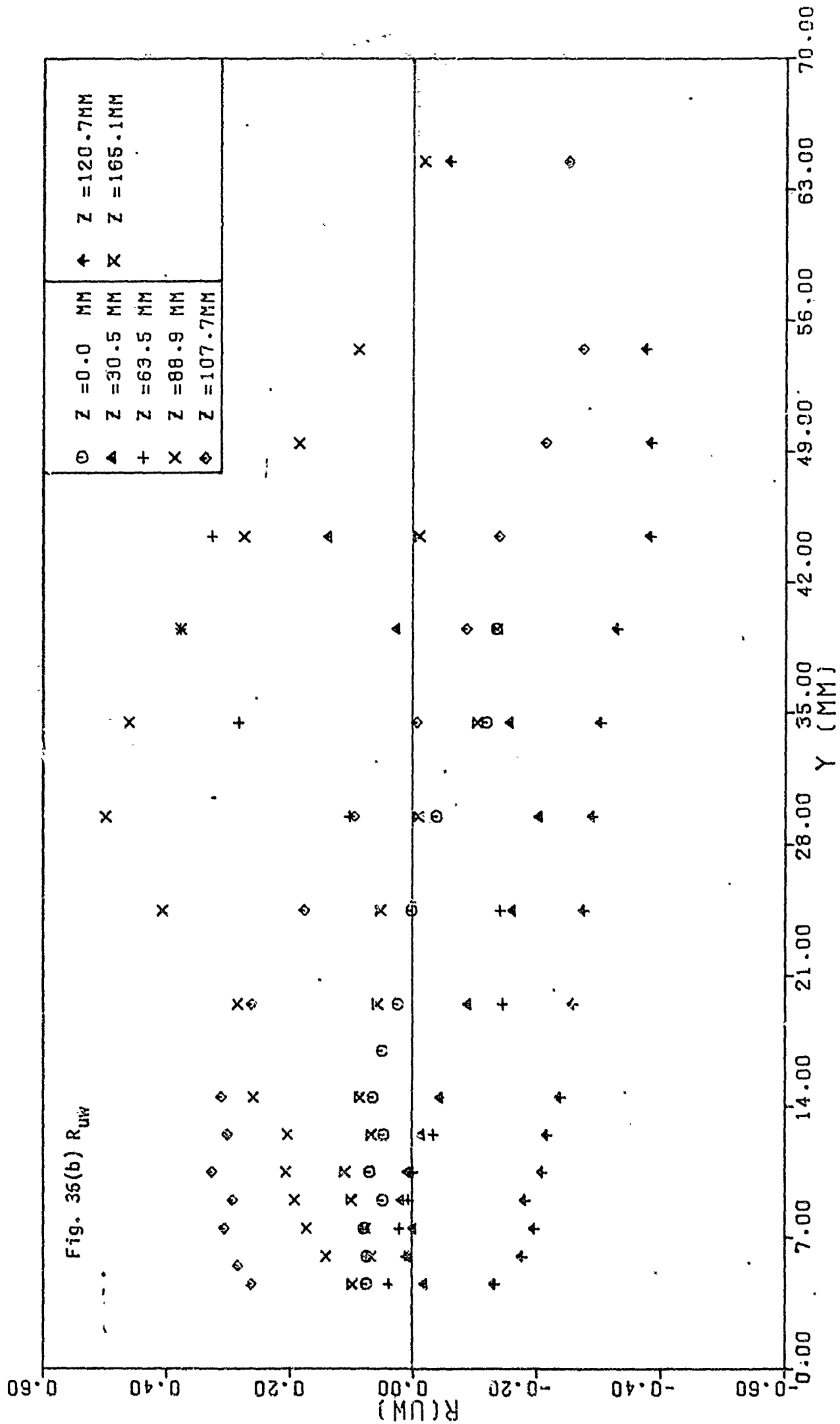
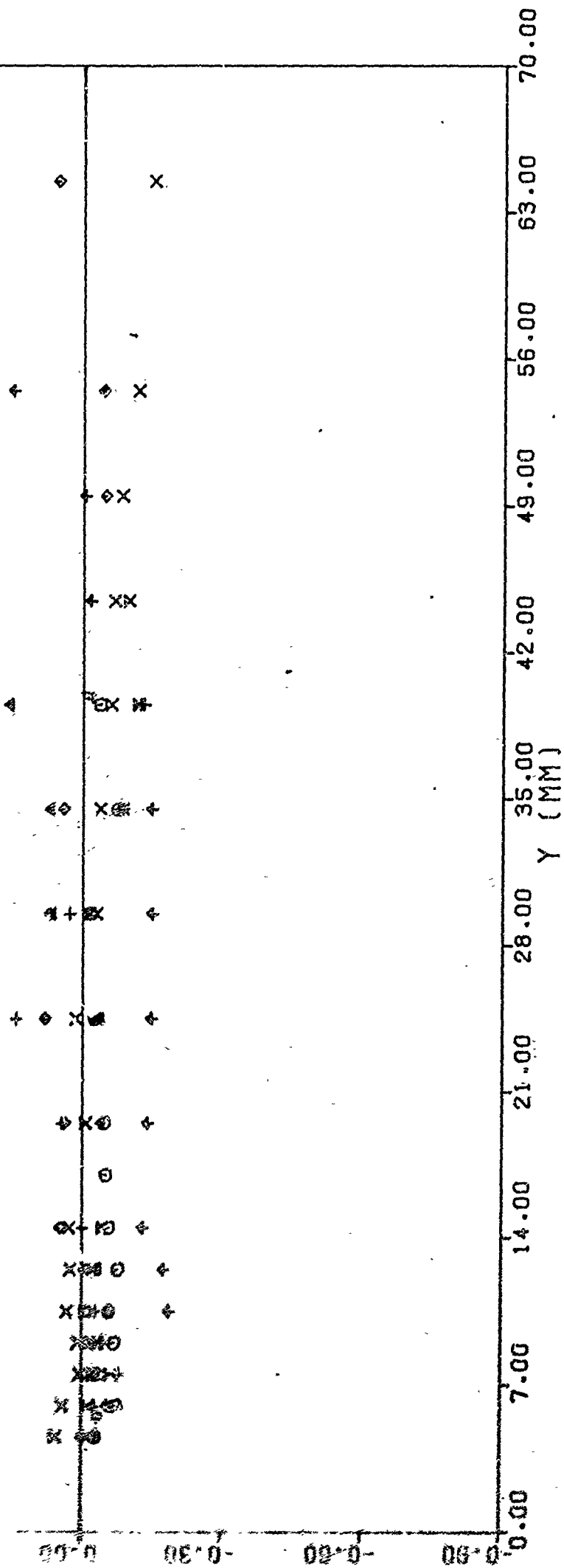


Fig. 35(c)  $B_{vw}$

0	2 = 0.0	MM	+	2 = 120.7MM
4	2 = 30.5	MM	X	2 = 165.1MM
+	2 = 63.5	MM		
X	2 = 88.9	MM		
0	2 = 107.7	MM		



0.21

0.14

0.07

$U_3/U_{E3} \times 10^{-3}$

-0.07

-0.14

-0.21

Fig. 37 Triple product normalized by  $U_e^3$ ,  $x = 2550$  mm

Fig. 37(a)  $u^3$

○	Z = 000 MM	+	Z = 120.7 MM
△	Z = 30.5 MM	x	Z = 165.1 MM
+	Z = 63.5 MM		
x	Z = 68.9 MM		
◇	Z = 107.7 MM		

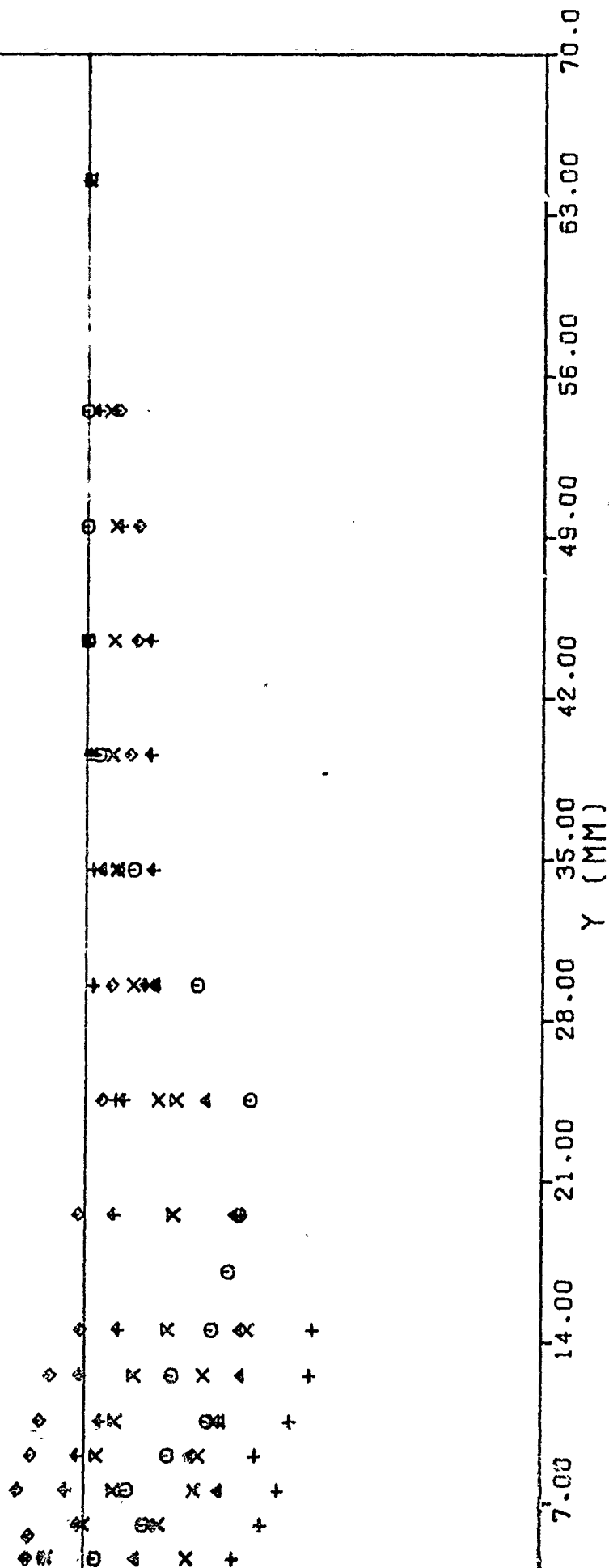
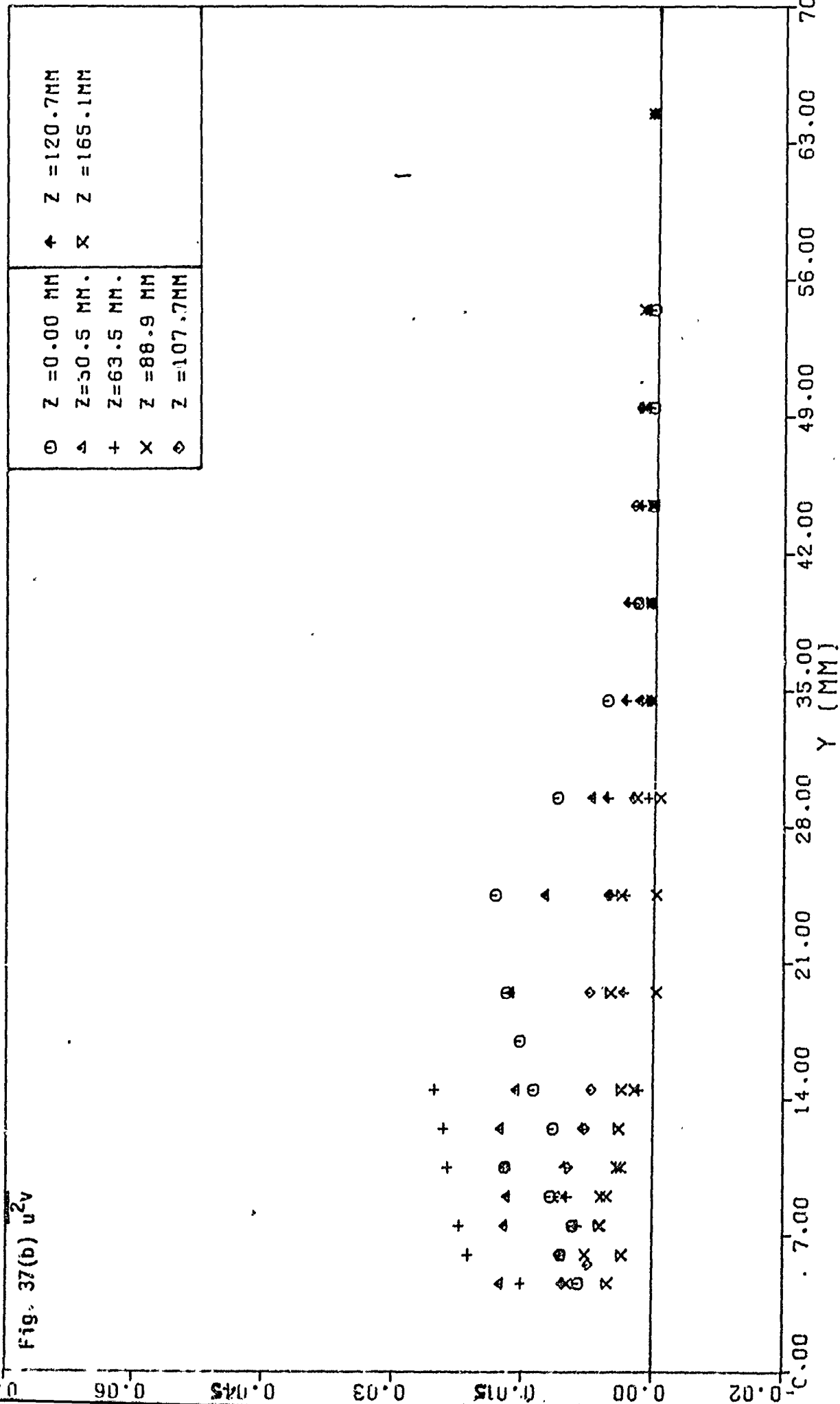
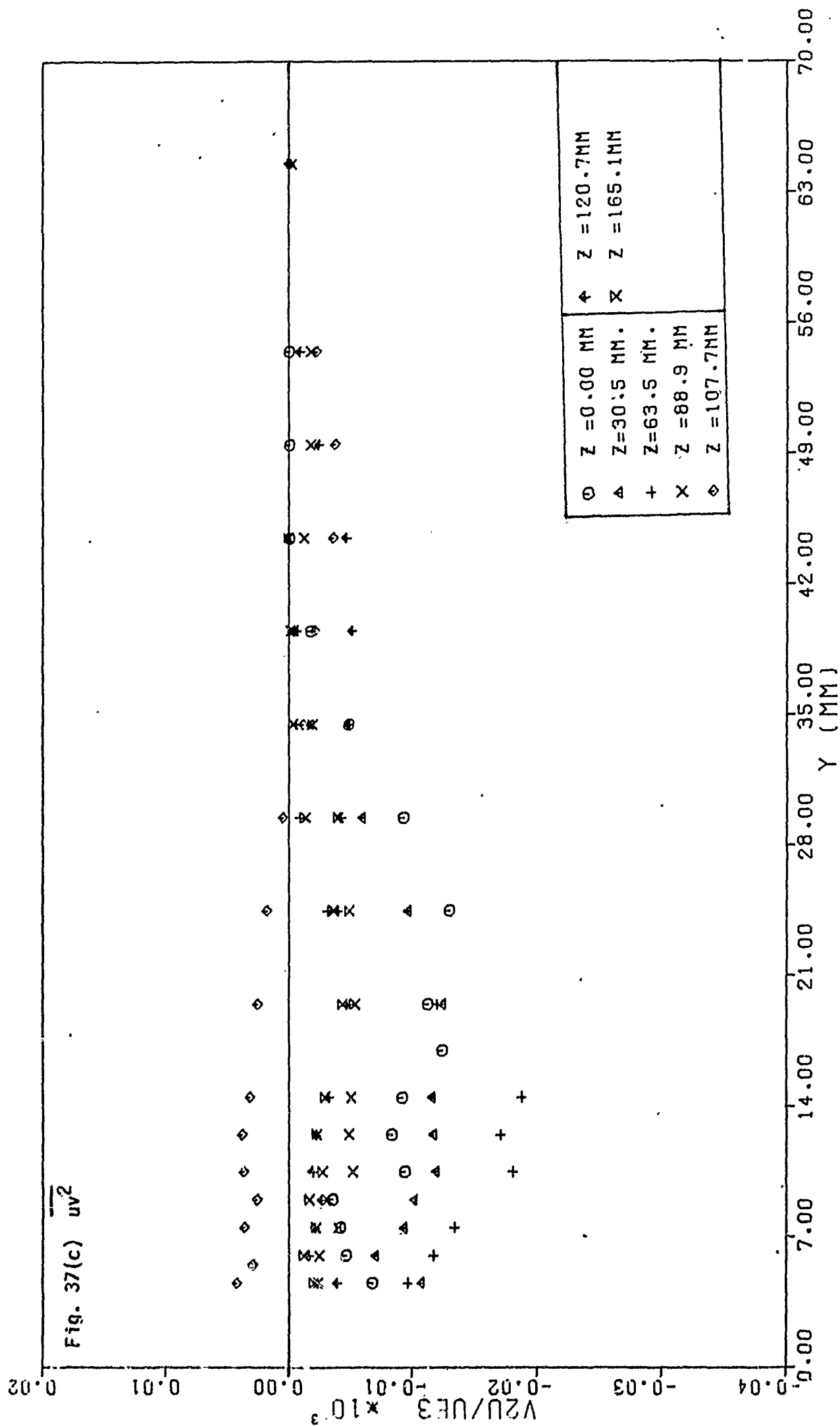
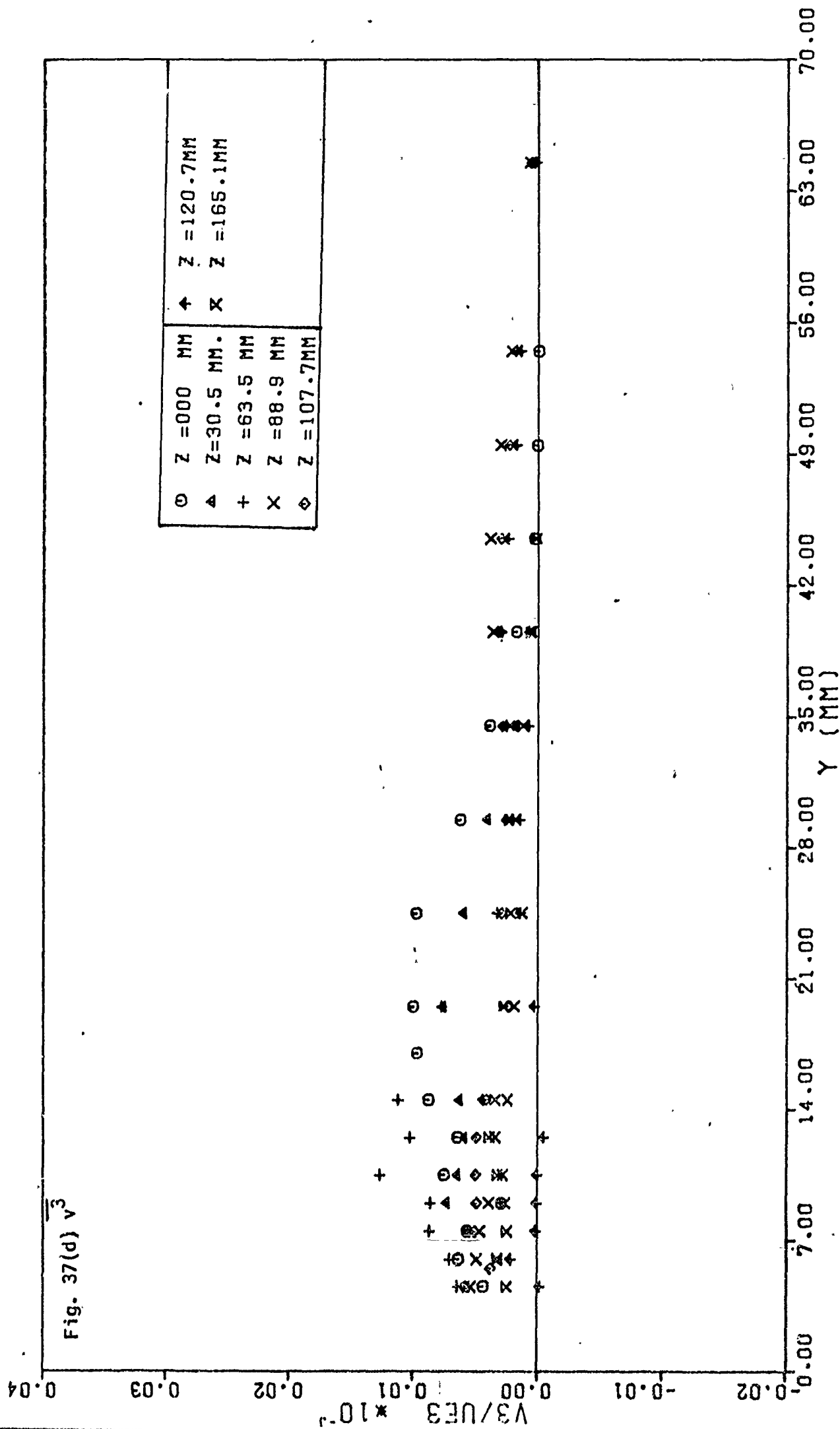




Fig. 37(b)  $u^2v$







0.12

0.09

0.06

$u_{2W}/u_{E3} \times 10^{-3}$

-0.03

0.06

Fig. 37(e)  $\overline{u_{2W}^2}$

$\uparrow$  Z = 120.7MM  
 $\times$  Z = 165.1MM

$\odot$  Z = 0.0 MM  
 $\blacktriangle$  Z = 30.5 MM  
 $+$  Z = 63.5 MM  
 $\times$  Z = 88.9 MM  
 $\diamond$  Z = 107.7MM

0.00

7.00

14.00

21.00

28.00

35.00  
Y (MM)

42.00

49.00

56.00

63.00

70.00

0.08

0.06

0.04

0.02

0.00

-0.02

-0.04

0.04

Fig. 37(f)  $uw^2$

$\uparrow$  Z = 0.0 MM

$\blacktriangle$  Z = 30.5 MM

$+$  Z = 63.5 MM

$\times$  Z = 88.9 MM

$\diamond$  Z = 107.7 MM

$\uparrow$  Z = 120.7 MM

$\blacktriangle$  Z = 165.1 MM

0.00

7.00

14.00

21.00

28.00

35.00

42.00

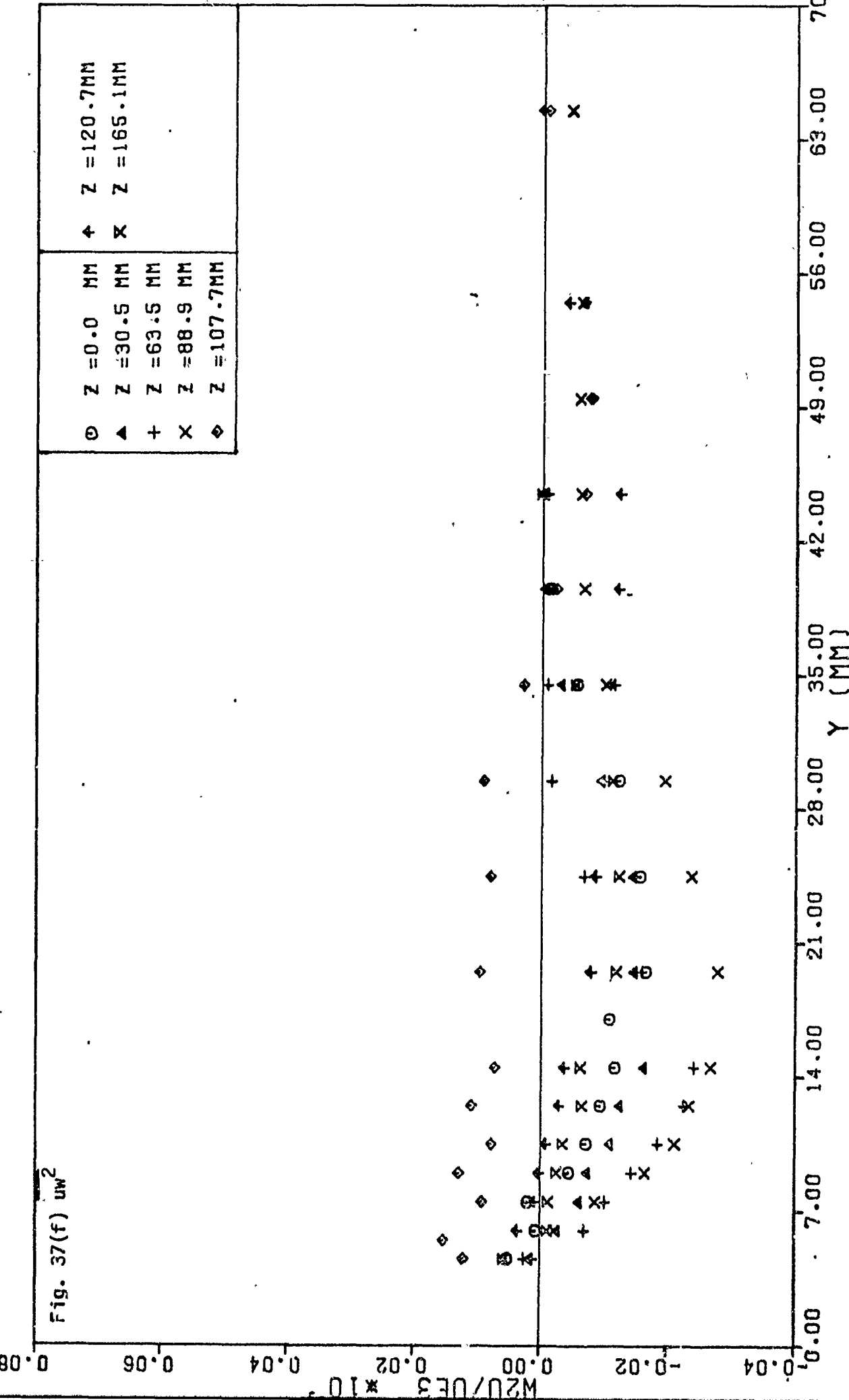
49.00

56.00

63.00

70.00

Y (MM)



0.08

0.06

0.04

0.02

$M3/UE3 \times 10^3$

0.00

-0.02

-0.04

Fig. 37(g)  $\overline{w^3}$

○	Z = 0.0	MM	↑	Z = 115.7MM
△	Z = 30.5	MM	×	Z = 165.1MM
+	Z = 63.5	MM		
×	Z = 88.9	MM		
◇	Z = 108.0	MM		

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

7.00

14.00

21.00

28.00

35.00

42.00

49.00

56.00

63.00

70.00

77.00

84.00

91.00

98.00

105.00

112.00

119.00

126.00

133.00

140.00

147.00

154.00

161.00

168.00

175.00

182.00

189.00

196.00

203.00

210.00

217.00

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252.00

259.00

266.00

273.00

280.00

287.00

294.00

301.00

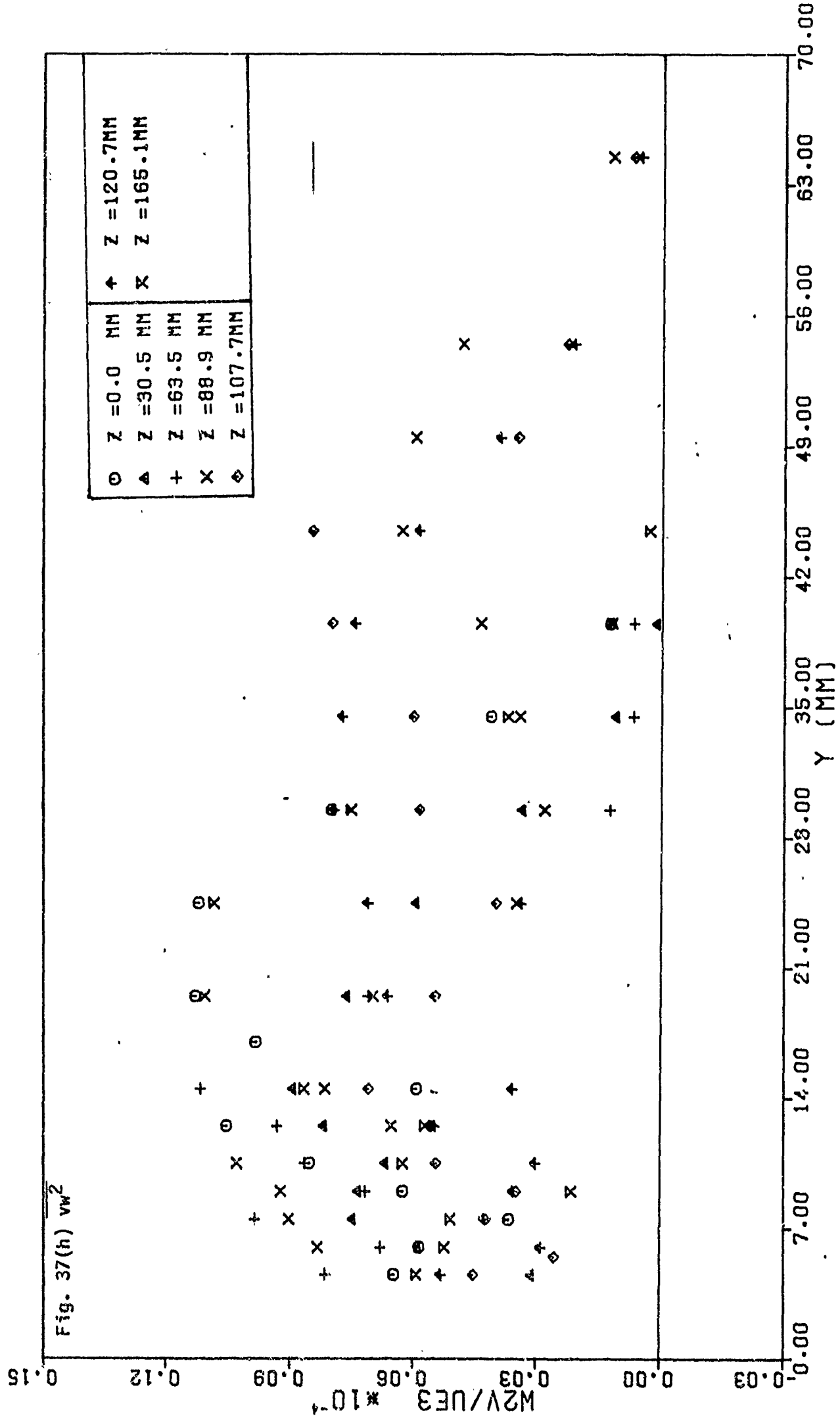
308.00

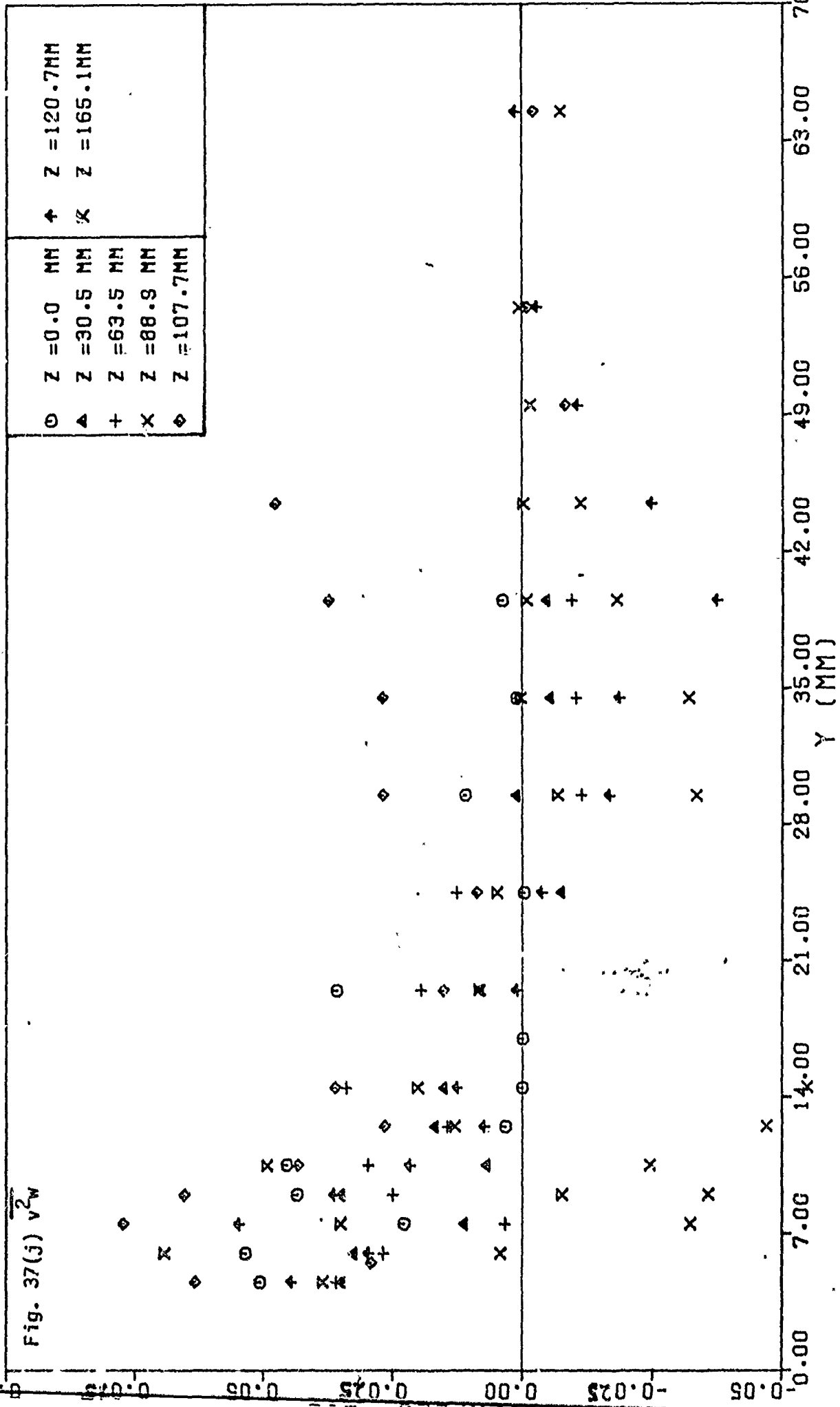
315.00

322.00

Y (MM)

Fig. 37(h)  $v_w^2$







0.25

0.20

0.15

0.10

0.05

0.00

0.05

Fig. 37(k)  $\overline{uvw}$

○ Z = 0.0 MM

△ Z = 30.5 MM

+ Z = 63.5 MM

x Z = 88.9 MM

◇ Z = 107.7 MM

↑ Z = 120.7 MM

x Z = 165.1 MM

Y (MM)

0.00

7.00

14.00

21.00

28.00

35.00

42.00

49.00

56.00

63.00

70.00

5.00

4.00

3.00

SKEM(V)

1.00

0.00

1.00

Fig. 38 Higher-order moments,  $x = 2050$  mm

Fig. 38(a) v-component skewness

⊙	Z = 0.00 MM	△	Z = 120.7 MM
△	Z = 30.5 MM.	×	Z = 165.1 MM
+	Z = 63.5 MM.		
×	Z = 88.9 MM		
◇	Z = 107.7 MM		

×

⊙

×

⊙

⊙

+

+

+

+

+

+

+

+

+

×

×

×

×

×

×

×

×

×

×

×

×

×

×

0.00

7.00

14.00

21.00

28.00

35.00

42.00

49.00

56.00

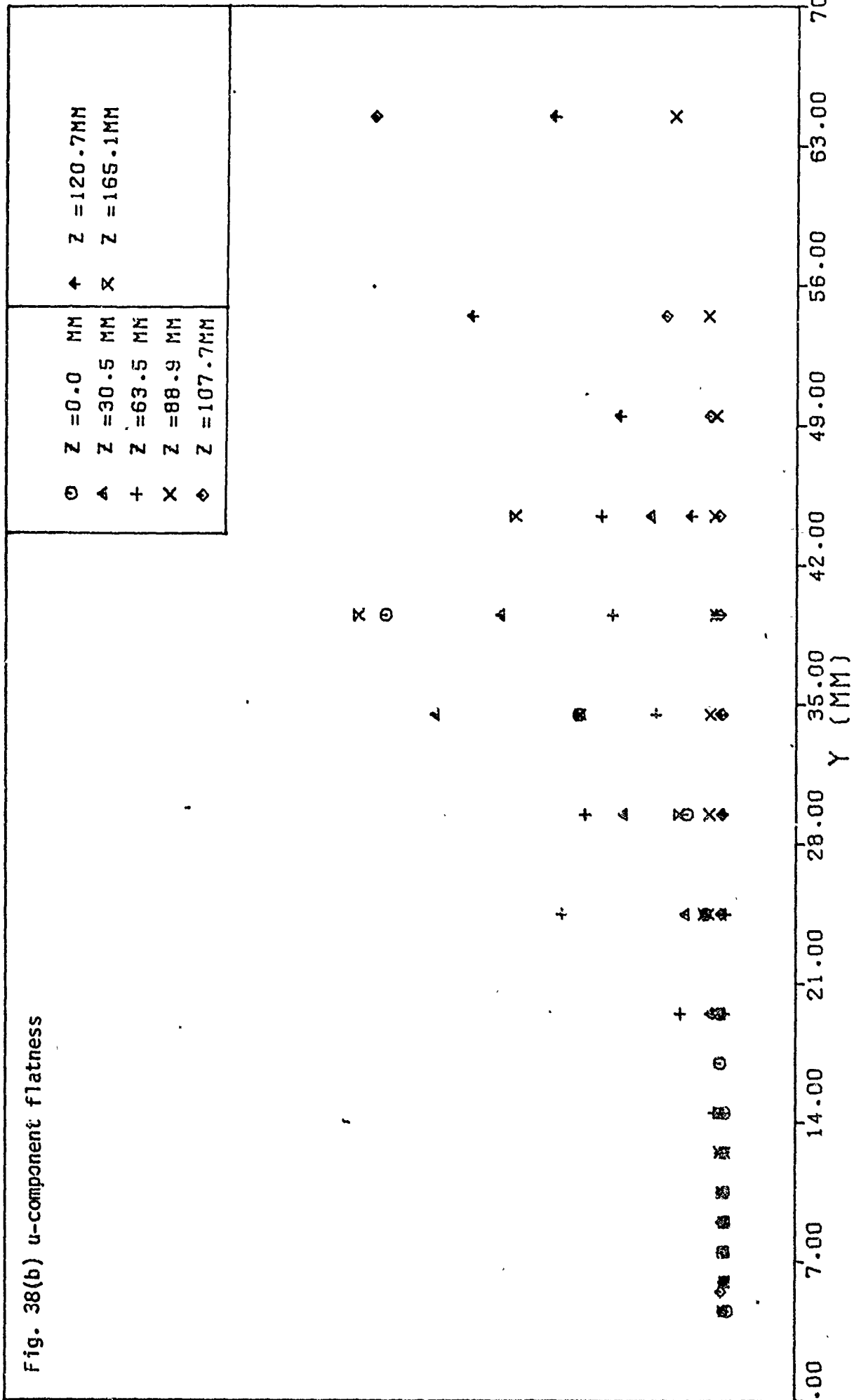
63.00

70.0

Y (MM)

FLAT(U)

Fig. 38(b) u-component flatness



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